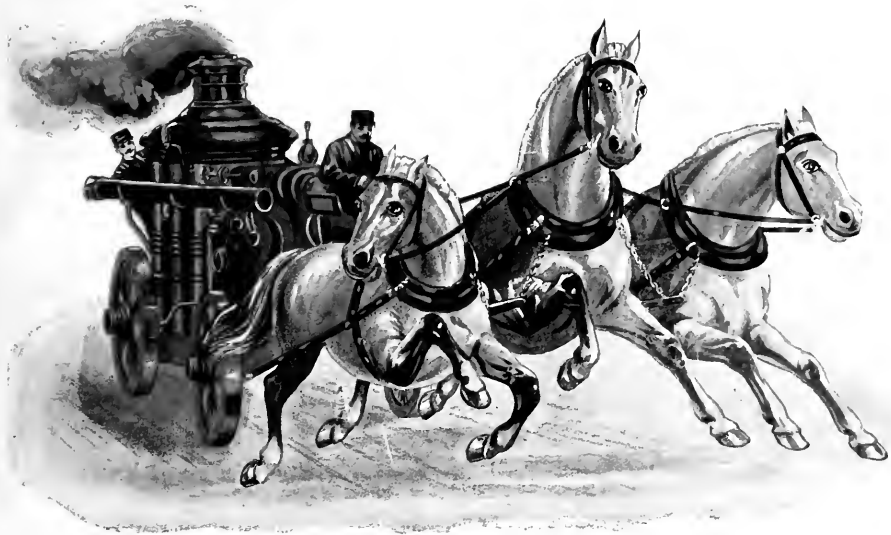


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**The 30th ANNIVERSARY  
AND ANNUAL FIRE BOOK  
*of the* VETERAN FIREMEN'S  
ASSOCIATION *of* SAN  
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**[ August Fourth, Nineteen  
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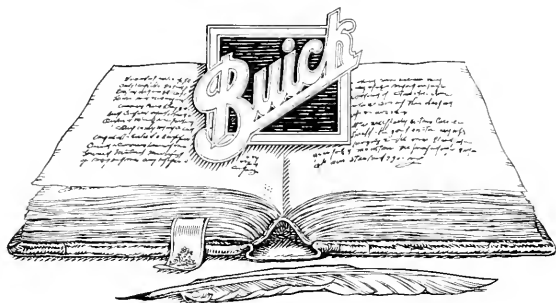
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*The brilliant record of the Buick Motor Company during the past quarter of a century is the pride of motordom. But the builders of Buick and the new Marquette hold everlastingly true to their policy of progress. They will continue to press onward to still greater heights of service.*

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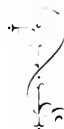
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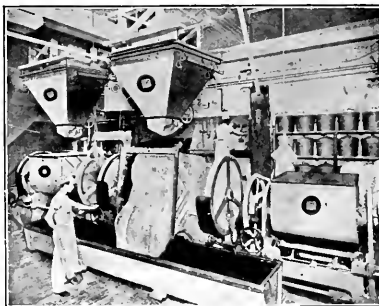
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That is the Supreme Court's definition. But good will goes deeper than mere satisfaction over a business deal.

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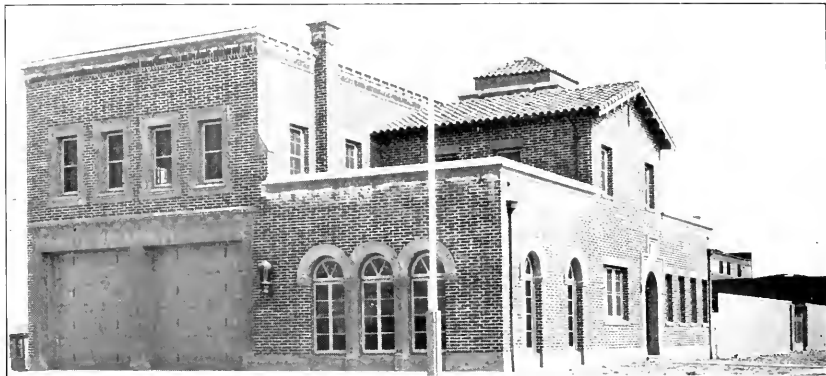
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# Veteran Firemen's Association of San Francisco

---

The Veteran Firemen's Association, Inc., of San Francisco, sprang into existence November 30, 1898, with about fifteen members, who organized by the selection of temporary officers—President, Samuel McDowell; Vice-President, Thomas Sawyer; Secretary, W. G. Cue; Treasurer, Pat Fleming.

The first regular meeting was held January 25, 1899, in the hall of Exempt Fire Company, Brenham Place, and elected the following permanent officers:

President, Geo. W. Kennard; First Vice-President, Richard Cox; Second Vice-President, Thos. R. Carew; Recording Secretary, W. G. Cue; Financial Secretary, Jas. B. Barber; Treasurer, Fred C. Hensley; Marshal, J. T. Bonifield.

Board of Directors—Chairman, J. J. Mahoney; A. B. Truman, James Grady, Samuel McDowell, J. W. Kentzel, M. M. Baker, and Thomas Sawyer.

The Charter Roll was closed May 2, 1899, with thirty members; the Association incorporated June 10, 1899; the Association today, August 1, 1929, has a membership of 642.

"Heroism is the self-devotion of genius manifesting itself in action."—Hare.

"Theirs not to reason why,  
Theirs but to do or die."—Tennyson.



## Object of the Association

---

The purpose of this Association is to promote and cultivate social intercourse, keep alive old friendships among comrades who have fought fires together and to create and maintain a fund out of which to pay one hundred dollars (\$100.00) toward the funeral expenses of deceased comrades. The benevolent side of this purpose is most worthy and its social side is no less meritorious. A large number of the Association's members are today in active service in the City Fire Department. To belong to the Association it is required that the members shall have served at least five consecutive years in the paid Fire Department of this city, or at any time between

1866 and 1886. The membership also includes many who were present and worked to preserve property and lives in the big fires that are recorded in San Francisco's history. When the history of our veteran firemen is written in detail every man will be proud to think he belongs to the organization.

In the annals of San Francisco, no chapters are more interesting than those relating to the firemen. Their brave work in the various fires that have threatened the city's destruction can never be forgotten. The firemen today are doing in the course of their daily duty work that ranks among the heroic deeds of the century.



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USE WATER  
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Read What An Experienced Fire Fighter Says:

"I have just received a circular describing your Smith 'INDIAN' Fire Pump.

"Permit me to say that we already have two of these Indian Pumps and that they have proved of extraordinary value to us.

"Shortly after acquiring these 'Indian' pack pumps we had a grass fire suddenly menace a whole neighborhood in the city. A heavy growth of grass became afire and the location was such that we would have had to lay perhaps two or three thousand feet of hose from the nearest hydrant to reach the fire. However, with our two Indian pumps, which we refilled from garden hydrants in the neighborhood, we succeeded in overcoming the fire without laying a single section of hose. I attribute this success as well as others directly to the portability of the Indian and its functioning at all times."

Cordially yours,  
(Signed) MILES D. COHLIN,  
Chief of Nevada City Fire Department.

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W. H. WILLIAMS  
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JOHN FARLEY	<i>Recording Secretary</i>



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Financial Secretary*



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The present officers are: Captain W. J. Kenealy, Lieut. H. Tricou, Clerk J. J. Brady.

Directors: C. Connell, A. Florence, C. Runfeld.

The Uniform Rank of the Veteran Firemen's Association was organized May 6, 1920, by Comrades P. Diez, C. Connell, W. Peake, S. Baker, J. Cain, H. Robinet, F. Smith and J. Dever.

The object sought in forming the rank was to perpetuate the memories of the volunteer firemen of two generations ago. The uniform worn by the members is an exact replica of that in vogue in the days of the volunteer.

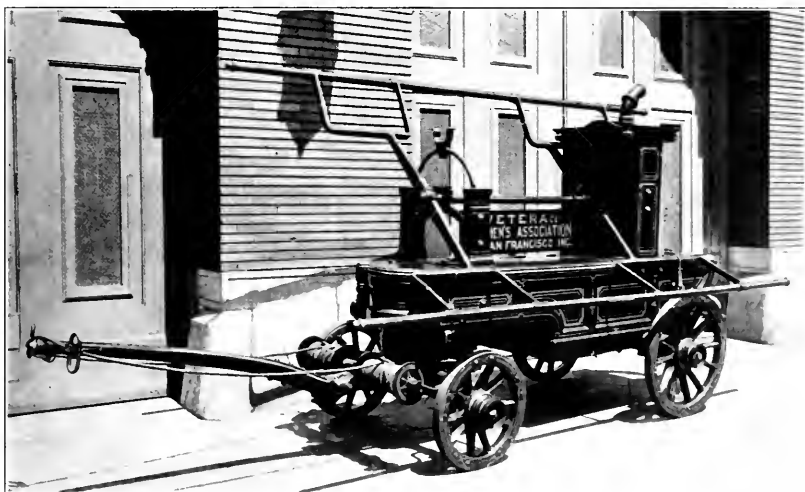
The apparatus, pumps and hose reels are the very ones they used in running to and extinguishing fires.

The Uniform Rank has participated in many important events since its organization and has been invited to others being planned for the future.



J. J. BRADY, Clerk

Honorary members: Thos. R. Murphy, Samuel Short, Michael Dunphy, Geo. Barron, Geo. Blum and Dr. T. P. Bodkin.



This engine was brought to California in 1849, and was used by the San Francisco Volunteer Fire Department for about a year, and was then purchased by Barron, Boltob & Company for fire protection in the quicksilver mines at Almaden, Santa Clara County.

This engine is unquestionably the oldest in California and was patterned after the original fire engine built in Philadelphia in 1730. It is now the property of the Veteran Firemen's Association of San Francisco and was obtained for them through the activity of our Comrade, Captain Wm. J. Kenealey, of Engine 14, S. F. F. D.

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# A FIREMAN

Compiled by

CAPTAIN MICHAEL RUDONICK, ENGINE COMPANY 31, S. F. F. D.

**B**ACK in the dim ages, the human family protected itself against an enemy, whether it be an enemy clan or tribe, or the beast of the jungle, by making their habitat in caves, or upon cliffs, or by surrounding their abode with brick or stone. In the transition of time and progress, man has evolved to his present state of civilization, but it is still necessary for him to wall himself against the enemy, Fire, and even this is inadequate for complete protection against so an insidious a foe. In addition to the walls of brick and stone, he is given protection by walls of flesh and blood, this being the personnel of a Fire Department. Under the present form of living conditions, wherein large numbers of humans dwell in congested surroundings, the fire hazard exists and is ever increasing. We are spending large amounts of money to prevent the ravages of fire, which, although one of man's greatest servants, it is also one of his most subtle enemies in the destruction of life and property, respecting neither wealth, position, nor class. In a rapidly changing world, it is natural that fire department practices have been constantly changed and improved. The efficient fire department of to-day supervises many operations in addition to the very necessary function of fire extinguishment. Such matters as physical training of the firemen, the study of chemistry of fire and explosions, modern drill school evolutions, first aid, practical hydraulics, ventilation, building construction, salvage operations, the investigation and prosecution of incendiarism, and the valuable work of actually preventing the occurrence of fires through the up-to-date conservation activities, dignify the fire force as a scientific and essential service to the community. In order that these operations shall function properly, men of a high standard of intelligence and physical ability are necessary, therefore, San Francisco subjects candidates for membership in its fire department to a rigid examination and in such manner as is enumerated in the following paragraphs,

A public notice is given that the Civil Service Commission will conduct an examination for Firemen, and application forms and a scope of the examination is furnished to those desiring to participate. The subjects and their relative weights on a scale of 100 are: Relative Capacity and Gen-

eral Knowledge of Duties, 50; Athletic Test, 40; Physical Excellence, 10. The applicants must be citizens of the United States, not less than twenty-one or more than thirty-five years of age, residents of San Francisco for at least five years next preceding the date of their application; and must pass a satisfactory medical examination before physicians employed by the Civil Service Commission.

In Part One of the medical examination, the applicant is required to answer the questions on a printed form furnished him, relative to his physical condition.

Part Two is a test of the eyesight and hearing.

**Eyesight**—Applicant must be able to read 20:30 with each eye and a 20:20 combined (Snellen's Test), without glasses and also pass a satisfactory color test with colored yarns.

**Hearing**—Applicant must be able to hear, with each ear, ordinary conversation at a distance of twenty feet, or the ticking of a watch at a distance of two feet.

**Part Three—Measurements.** No applicant will be accepted whose measurements, stripped, do not come up to the following standards:

Height	Minimum Weight	Maximum Weight	*Chest* Expanded
**5 ft. 7 in.	140 lbs.	170 lbs.	36 in.
5 ft. 8 in.	145 lbs.	175 lbs.	37 in.
5 ft. 9 in.	150 lbs.	180 lbs.	38 in.
5 ft. 10 in.	155 lbs.	185 lbs.	38½ in.
5 ft. 11 in.	160 lbs.	195 lbs.	39 in.
6 ft.	165 lbs.	200 lbs.	40 in.
6 ft. 1 in.	170 lbs.	205 lbs.	40½ in.
6 ft. 2 in.	175 lbs.	215 lbs.	41 in.
6 ft. 3 in.	180 lbs.	220 lbs.	41½ in.
**6 ft. 4 in.	185 lbs.	225 lbs.	42 in.

\*Minimum chest expansion, 3 inches. \*\*Minimum height.

\*\*\*Maximum height.

(Note.—Fractions in height over one-half inch must meet requirements of next higher schedule and fractions less than one-half inch must meet requirements of next lower schedule. Fraction of even one-half inch in height may carry next higher or next lower schedule as favors applicant.)

**Part Four—Inspection by Board of Medical Examiners.** Physique (excellent, good, fair or poor). Appearance and Bearing (excellent, good, fair or poor).

Part Five consists of a general examination of  
(Continued on Page 35)

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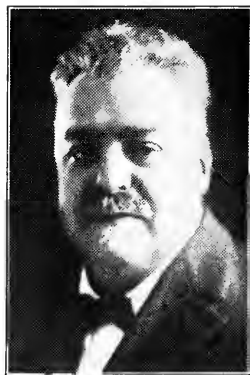


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## A FIREMAN (Continued)

the applicant, wherein his declaration as given in part one must prove satisfactory. Under this heading his complete medical history is obtained and note is made of any additions, when there is evidence, of excessive use of tobacco, etc. If the applicant is rejected during the progress of this medical examination for being unable to fulfill the requirements of this board, he is eliminated from further participation.

The "Athletic Test" for both examinations will consist of the following:

1. Ladder Work—Hand over hand, up and down 10 rungs. Only one hand allowed on each rung. Perfect mark, 10 credits.

2. Lifting 50-lb. Dumb Bell—Five consecutive lifts with each hand. Lifts to be made from lowest reach of arm to highest reach, without aid of jerk or swing, while standing erect with feet close together. Perfect mark, 10 credits.

3. High Jump—4 ft., 10 credits; 3 ft. 8 in., 8 credits, 3 ft. 4 in., 6 credits. Use of spring-board not permitted.

4. Vaulting the Horse—Perfect vault over horse 4 ft. 6 in. high, without touching it with any part of body except the hands, 10 credits, good vault (feet slightly touching horse), 8 credits; fair vault (body slightly touching the horse), 6 credits; slide over horse, 0.

5. Dipping on Parallel Bars—Five dips at 2 credits each. Dips must be made with legs straight and without assistance of kick or swing.

6. Carrying 150-lb. Sack of Sand—Sack must be lifted from floor, placed on shoulder and carried up and down six steps. Mark, 10 credits. No partial credits, and no more than two trials allowed.

7. Running (distance about 145 yards)—18 seconds, 40 credits; 19 seconds, 37½; 20 seconds, 35; 21 seconds, 32½; 22 seconds, 30; 23 seconds, 25; 24 seconds, 20; 25 seconds, 15; 26 seconds, 10; 27 seconds, 5. Fifth-seconds to be rated proportionately.

Applicants receiving a rating of less than 75 on the subject "Athletic Test" shall stand rejected.

The written test on "Relative Capacity and General Knowledge of Duties" consists of the following subjects: Arithmetic, Spelling, Word Knowledge, Grammar, Penmanship, Knowledge of the Geography of the City, Knowledge of the contents of a booklet that is furnished by the Civil

Service Commission to those who have passed the medical examination and the athletic test satisfactorily. This booklet contains excerpts of the laws, rules, regulations, etc., appertaining to the duties of a fireman, which he may study in preparation for the examination. These questions are put in the "True" or "False" type of examination.

This "Written Test" is a silent examination, and gong signals are used to announce the beginning and ending of the examination and its various parts. The approximate time for each test is as follows: Arithmetic, 20 minutes; Spelling, 3 minutes; Grammar, 6 minutes; Word Knowledge, 4 minutes; Knowledge of the City, 8 minutes; Penmanship, 5 minutes; Knowledge of Duties, 15 minutes. In all of the subjects, excepting Arithmetic and Penmanship, each incorrect answer given will cancel one correct answer; this penalty is imposed to discourage guessing.

The competitor having the best papers is given the highest rating and the others are rated according to their relative excellence. After the compilation of the total credits attained by each competitor, a passing mark is set by the Civil Service Commission. The ratings and numbers on the eligible list are then announced in the order of the general average attained. Those who have not attained a rating sufficient to pass the mark as set by the Commission stand rejected. After the completion of each of the three major tests, fingerprints of each competitor are taken, and a comparison is made of these prints, which precludes the possibility of anyone substituting himself for any participant.

When a requisition is made upon the Civil Service Commission for a Fireman, they certify the next highest eligible from the eligible list and he is appointed by the Fire Commissioners, subject to a six months probationary period. He is then assigned to a company for duty and is instructed by the officer in charge as to the duties of a fireman. He must attend Drill School twice daily, when on day tour, excepting on such days as are set aside for the Officers, and at such other times as the Drill School may be inoperative in accordance with the rules of the department.

This Drill School is modern throughout, and fully equipped for the training of firemen and all instructions and training are given under the supervision of the Drillmaster. Some of the features of this Drill School are a seven story fire-proof building, standpipes, fire escapes, sprinkler system, pipe casing holes, basement trap doors, a

(Continued on Page 37)

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## A FIREMAN (Continued)

miniature building which is used to teach the science of ventilation, telegraph key for sending messages in the Morse Code, different types of hydrants, and a complete set of tools and appliances used in connection with the operation of the department. The candidate is instructed as to the name and proper use of all these appliances, which are put into use the same as they would be used while working at a fire. He must scale the sheer side of the seven story building, floor by floor, until the roof is reached, using a pompiér ladder. After reaching the roof of the building he makes a descent on a life line by the aid of a life belt. The purpose of this particular drill is to accustom the fireman to working at great heights and to teach him rescue work. He is taught to wear an oxygen helmet, which is used at extremely smoky fires or in the presence of poisonous fumes, and he is then subjected to an actual test in the fire-proof smoke room prepared for this purpose. Deluge sets, such as water towers, turret wagons, etc., are put into operation being supplied with water from the high pressure water system. The use of all ladders in the department is taught and instructions as to the carrying, raising and lowering of the various ladders are given.

The operation of Engine, Truck, Chemical, and the various other companies is taught, so that in the event of detail, reassignment, or transfer the member will be able to perform his required duties in an efficient manner.

When in the judgment of the Drillmaster he has become efficient in his required duties, he has completed his probationary term at the Drill School and thereafter he will take his regular turn in attending the school with the other members of his company.

Members who show exceptional ability in the operation of special types of apparatus, of which there are many makes and kinds in the department, are assigned to these duties. A complete record is kept by the captain of the company to which he is assigned relative to his department and firemanship and, within thirty days before the expiration of his probationary term, a report in full is filed with the Board of Fire Commissioners by such officer, with a recommendation for the appointment or non-appointment of such member, setting forth his reasons therefor. If he has fulfilled all these requirements and his physical condition is satisfactory to the Department Physician after the completion of his probationary term, he is appointed as a permanent member of the Department by the Fire Commissioners.

In the last examination held there were 1326 applicants and 608 were eliminated during the progress of the medical examination and athletic test. Of the remaining 718 applicants eligible to participate in the written examination 593 were successful and 125 failed. The results of this type of examination and the drill school evolutions are seen in the high standard of efficiency maintained in the San Francisco Fire Department.

## FIRE RESISTANCE OF HOLLOW TILE WALLS

According to tests which were conducted on hollow tile walls by the Bureau of Standards of the Department of Commerce, an 8-inch hollow tile wall has been found to be adequate for residences. The tests were made in cooperation with the Hollow Building Tile Association.

These tests were planned to yield more information on the properties of hollow tile, such as the strength of tile walls, and more especially the fire resistance of such walls.

Two sizes of walls were tested—one 16 feet long and 11 feet high, the other 4 feet long and 4 feet high. The walls were built just as they would be built in a building and when they had aged a month or more they were placed to form one side of the furnace in which the tests were made. The fire in the furnace was regulated during the test so as to approximate that obtained in severe fires in burning buildings.

The tests show the ability of tile walls to carry load during the burning of a building and also to prevent the spread of fire when they are used as party or fire walls. They show that 8-inch tile walls would be adequate for residence and office buildings and institutions in which no considerable amount of combustible material is allowed to collect. For stores or factories containing only a moderate amount of combustible material a 12-inch wall would be required. For factories having a considerable amount of combustible material or for warehouses, a wall heavier than 12 inches would be required, particularly if the wall is not plastered.

The results of these tests are considered of great value to the industry and the public, as well as to the building commissioners, in that they give reliable information on the extent to which hollow tile walls can be relied upon for protection in case of fire.

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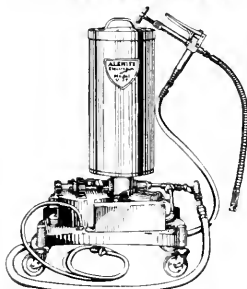
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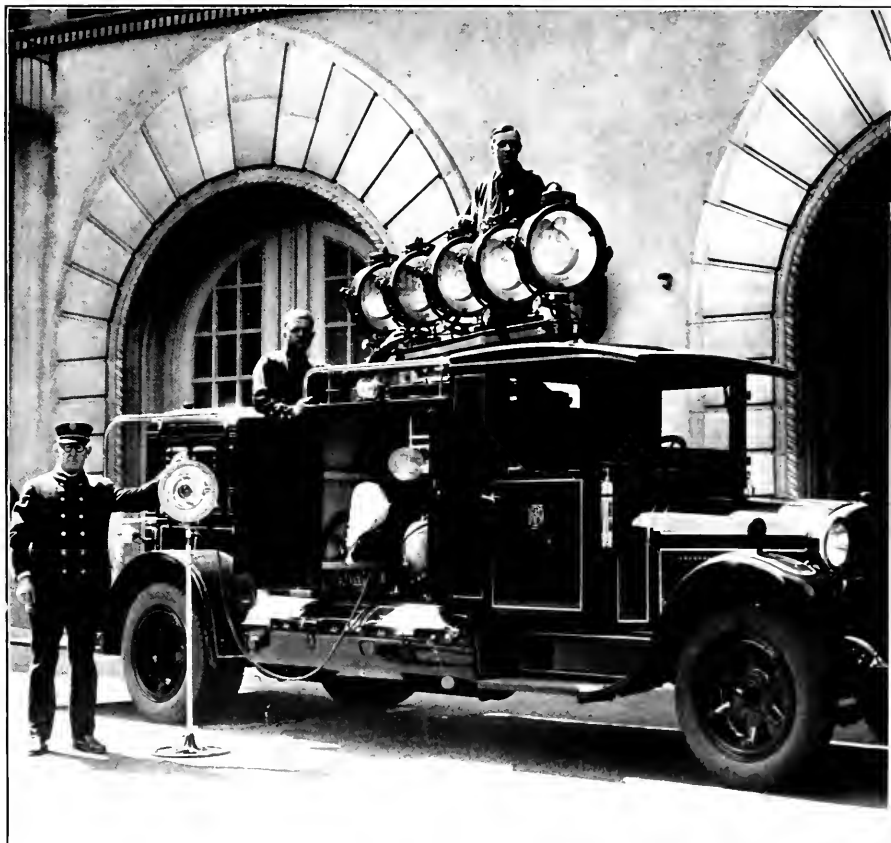
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# *Powerful Floodlighting Units of San Francisco Fire Department*



*Courtesy - The Museum of Fire Arts*

See Page 41 for Description

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Two powerful searchlight units, designed and assembled under the supervision of Samuel Bermingham, superintendent, and Harold H. Jones, general foreman of the Fire Department's corporation yards—and badly needed to expedite the work of rescuing lives and saving property—have been added to Fire Department equipment.

## Mounted on Trucks

Each unit is mounted on a two-ton Kleiber specially designed truck, equipped with pneumatic tires. The electrical unit is of the Kohler Manufacturing type, with a capacity of 10 K.W. There also is provided a distributing switchboard, a turntable on top of the body, containing five swivel flood lights. The portable lighting equipment consists of eight portable lights, together with eight adjustable standees, and a metallic cabinet for the proper stowing of the portable lights, extra globes, etc. The portable lights are served through eight reels, each containing 500 feet of rubber-covered flexible wire, considered of sufficient length to reach any portion of the interior of burning buildings.

## Designed for Department Use

The combined units were designed solely for Fire Department service. At this point it is not amiss to state that in a recent illuminating test of both searchlight units they were considered so satisfactory by the Fire Commissioners and Fire Department officials that no improvements or alterations were found to be necessary. Bermingham and Jones were highly complimented by the Fire officials.

The units will be used to illuminate the exterior and the interior of buildings and also for other emergency purposes where a large volume of light is necessary to expedite any work for the rescuing of life and property. The combined units have been made waterproof, so as to insure reliability with any condition of weather, and also from the spray of fire streams and the possibility of bursting hose lines.

## Electrical Equipment

The Kohler Electric unit, which consists of a gasoline motor directly connected to a 120-volt D.C. generator, is entirely automatic as to its starting, stopping and voltage regulation. Each flood light and portable light, circuit of which is controlled from the switchboard, is properly fused so that in case of a short circuit occurring the balance of the circuits as may be used will function.

The eight wire reels are unique in their construction and application. The electric current is supplied to each reel through brushes and collector rings of ample service to prevent arcing. The terminals of each reel are of the marine type, waterproof, which prevents any operator from receiving a shock in damp weather. All reels may be rewound individually, or collectively, by a crank handle by use of respective clutches and locks.

The turntable, which supports the five flood lights, is mounted on rubber spring shackles to relieve the globes of any undue jar from road shocks. On a recent test the apparatus was driven for fifty miles over rough streets, car tracks, etc., without any damage to the filaments in any of the lamp globes.

The apparatus has a speed of thirty-five miles per hour on the level, with corresponding reduced speeds to negotiate different grades.

Each unit costs \$8200, and its combined weight, exclusive of operators, is 12,200 pounds. The candlepower of each flood light is 141,000.

The small portable lighting units are made of cast aluminum and are very light. They are equipped with 400-watt floodlighting lamps and give a light beam of more than 80,000 candlepower. They are supplied with sufficient portable cord to permit the firemen to carry the lighting unit to any part of the building, greatly improving the safety of fire-fighting in basements, lofts, etc. The large units are equipped with 1000-watt lamps and give a very wide spread with a light beam of 15,000 candlepower, and are capable of brilliantly lighting an entire block.

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# The Value of a Fire College to a Fire Department

By First Asst. Chief S. H. Dodd, Los Angeles Fire Department

There are several reasons why I believe the Fire Department of a large city should have a Fire College. In every fire department there are chief officers who have spent the greater part of their lives in the fire service, who are known to be efficient men, and the knowledge that they have gained regarding the city, its buildings, its hazards, and the operation of the fire department is invaluable. This knowledge has been acquired as a result of practical experience and the close study of fires, their prevention, control and extinguishment.

These officers no doubt can recall mistakes that have been made at fires, some of which were very costly, and from which they have profited by the experience gained. When these men leave the Department they take with them all the benefits of the years of experience in this work. If the results of this experience could be given to the younger officer, it would assist him in the different emergencies he may be called upon to meet.

We must realize that the ranking officers of today must think as professional engineers, having some knowledge of the construction of buildings, their desirable and undesirable points from the fire fighter's standpoint; water supply and its distribution; fire hazards of all kinds; a little knowledge of chemistry will sometimes save lives at fires. To acquire this knowledge a man must constantly study these and similar subjects, if he is to be a competent officer. We realize that no man can be intimately familiar with all phases of fire department work, but we believe that in the Fire College he will be enlightened on subjects of which he has little or no knowledge, and will therefore become more efficient. If the methods used and results obtained in handling fires involving great hazards are imparted to the younger men by the officers in charge of such fires, they will be better fitted when called upon to meet such emergencies. Again, the Fire College is the place where this information could be given.

We must also realize that as a result of rapidly changing times and conditions, bringing expansion of industry, with new processes of manufacturing, the manufacturer is more interested in the effect of these new processes upon his overhead expenses than he is upon the fire hazards in-

involved. Here again, if the fireman has adequate knowledge of how these hazards may be prevented or controlled, he will be able to formulate a plan of action and proceed accordingly. Without such knowledge he has nothing to guide him and his ignorance of such hazards might result disastrously. If he had previously received this knowledge in the Fire College he would be better equipped to handle such a situation.

We must realize today that courage alone is not a sufficient qualification. A man must know how to use his head in emergencies. Sometimes at a fire a man will endure great punishment in order to reach a desired position which could be reached more quickly and with less hardship if he had had some instruction as to the best course of action to follow in such a case. Again in this case, the course of instruction given in the Fire College would be of great assistance. He has heard the lectures and seen them illustrated with slides and moving pictures; he has been given the theory and puts it into practice; he sees it work out successfully and he realizes he still has much to learn in the fire fighting service. Thus the time spent in the Fire College has been of real benefit to him and to the Department, as well as to the community. Firemen should realize that whenever a mistake is made at a fire and property destroyed which might have been saved by a little headwork, it reduces the amount of taxable property, resulting in fewer property taxes and therefore less money available for the maintenance of the Fire Department.

In the Fire Department there are always a number of good, energetic men who are ambitious to advance and who study everything relative to fire department work, realizing that if they intend to follow this profession, they must fit themselves for advancement. They know that competition for higher positions is keen and that the instruction received in the school will better enable them to hold such positions.

There is also a class of men with a limited education, who are good firemen but are content to go along, thinking they are too old to learn and unable to express themselves in writing. They never study anything pertaining to their work until an examination is called, and then attempt in a few days to store in their minds the learning that should have been acquired through

(Continued on Page 45)

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## THE VALUE OF A FIRE COLLEGE TO A FIRE DEPARTMENT (Continued)

years of study and observation. If these men had attended the Fire College and taken the courses given there, they would be better prepared to pass an examination with a rating high enough to assure them a position, and the Department would also be benefited by securing good officers: whereas, if left to their own resources, they would never advance. By requiring them to attend the college, they soon realize they are receiving an education along lines they thought impossible, and again the Department benefits.

The Los Angeles City Civil Service Commission is given a copy of lectures and lessons which are presented in the course, and this Commission has cooperated with the Department by using this subject matter in examinations for higher positions in the Department. A certain per cent of credit is allowed in these examinations for graduation from this College, for it is realized that we

are trying to train our men along certain lines for the betterment of the Department.

Generally, a man passes an officer's examination and is certified to the Department for promotion. He is placed in charge of a company protecting a district which involves thousands of lives and hundreds of thousands of dollars' worth of property. If he makes a mistake that results in the loss of lives and property, the Department is criticised. Why shouldn't he be educated so that he can meet the emergency and use his own initiative, instead of hoping, as some do, that the chief will soon arrive and assume responsibility? He owes it to himself, to the Fire Department and to the tax-payers to better himself, so that he can give to the citizens of his community the best that is in him, and retain the respect which they now accord to the Fire Department.

## RADIO AND ITS USE FOR FIRE PROTECTION WORK

Among the scientific developments of modern times, is the radio. Fire Departments have kept pace with science, by calling into play those inventions that have been proven successful. Thus the telegraph and the telephone are two indispensable instruments of the fire departments throughout the Country. Radio holds out to us many opportunities in the task of preventing and fighting fires.

Radio can be brought into play in the work of fire prevention and fire protection. In the first place, nearly every second family boasts of a radio receiving set. Then there are innumerable broadcasting stations, and their number is on the increase. Some cities have installed and are operating municipal broadcasting stations. With the existing broadcasting stations and legion of receiving sets, we have without great or possibly any costs, a potent and far reaching means of educating the general public, in fire prevention and protection.

Under the direction of the fire commission or the chief of the department, courses of lectures might be given. Heretofore the radio has been used to broadcast fire prevention lectures, but only during fire prevention week. Yet if a course of such lectures be conducted weekly on the same day each week, over a period of several months each year, much better results will be obtained.

There are four main causes of fire—criminal intent, carelessness, ignorance and spontaneous ignition. Of these the radio can modify the last three causes. This can be done by radio lectures touching on the care, use and storage of certain hazardous substances and implements, such as gasoline, matches, oil lamps, oily rags and waste,

electric wiring and such other common substances, appliances and implements which give rise to fires that form the bulk of the nation's ash heap. Likewise such matters as cellars with accumulations of rubbish, obstructed fire escapes and locked means of egress, could be given the consideration which experience proves, they demand.

Domestic and commercial fire protection can be materially aided by the education of people in the utility and value of fire pails, fire extinguishers and appliances in the home, store, office or factory. Akin to this, we find often to the sorrow of those concerned, that there are many people who do not know how or where to transmit an alarm of fire. This means a delay in the arrival of the local fire department and a consequent spread of fire. In many cases it means the loss of life. This condition is traceable directly to ignorance—ignorance that can be removed in a most far reaching manner, by means of frequent radio fire prevention lectures.

In the work of fire fighting the trend of the times is toward the use of scientific methods. We find firemen and officers, the world over, studying ways and means of coping with fire situations in a more scientific manner. Fire schools and fire colleges are giving courses, state universities and colleges have opened special classes for fire officers, yet due to differences of time and place the majority of such men cannot avail themselves of these courses. The radio course in fire fighting, places all the advantages of attendance at a fire college or state university, within the reach of nearly every member of the fire department in many cities and towns.

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# The Hazards in the Use of Pyroxylin Lacquers

By R. B. MATHEWS

Special Agent, Home Insurance Co. of New York

Paper read at the Fifty-third Annual Meeting of the Fire Underwriters of the Pacific, February 5, 1929

**D**R. GUSTAVUS J. ESELEN, JR., of Boston in a recent discussion before a meeting of the American Chemical Society Institute at Northwestern University referred to a certain substance with which we are all familiar by association and use, if not by name, in the following allegorical fashion: "We wear it; we live in houses made of it; we record our news and literature upon; we even take it into our systems as food. What is it?" The speaker might have added that we paint our automobiles and furniture with it, use toilet sets and other fancy articles made of it, dress our wounds with it, are entertained at the movies and have our likenesses handed down to posterity in pictures made on it and employ it in our national defense in addition to a myriad of other every day uses. Dr. Eselen went on to say that by salvaging farm wastes, in which this substance appears, and utilizing them in industry, chemists hope to be of great assistance to agriculture. In the light of this prediction it is possible that this may be the solution in the Farm Relief Problem, and that we may in the future see a "Cellulose Plank" in our political party platforms for that is the name of the substance.

Cellulose is the principal structural material of vegetation, and is present in all plant life. Cotton fibre is almost pure cellulose, about 91 per cent to be exact, the remaining 9 per cent consisting of moisture, acids, oils, wax and other "impurities." Cellulose in its pure or chemically uncombined state is practically insoluble; and a peculiar property is its resistance to the action of other than powerful chemical reagents such as strong acids. By treating with a mixture of nitric and sulphuric acids, the process being known as nitration, a compound is formed which is known as nitro-cellulose. The nitrating process renders the resulting compound soluble in certain liquids, which is the purpose of the nitration in preparing cellulose for use in the manufacture of materials other than explosives.

Nitration is a comparatively simple process, consisting merely of mixing the cellulose (usually cotton fibre, but for some products shredded tissue paper or wood pulp) with nitric acid and sul-

phuric acids in a suitable container and stirring or agitating until thoroughly mixed and then allowing to stand until the desired degree of nitration is attained, after which the material is thoroughly washed in water to remove the free acid and thus prevent further chemical action. The strength of the acids used, the proportions of acid mixture and temperature, as well as the time that the process is allowed to continue, are all important factors as affecting the degree of nitration.

There are three classes of chemical compounds the names of which to the chemical or safety engineer versed in such matters are almost synonymous with fire hazard. These are the higher oxides or "peroxides," chlorates and nitrates. Look over any list of dangerous substances compiled by municipal explosive commissions or other regular safety organizations and you will find a rather formidable list of substances coming within these three general classes. Among these you will find the nitrates the most numerous. It is not to be inferred that all such compounds are hazardous as fire or explosion media. There are exceptions, of course, but the very mention of the names "peroxide," "chlorate" or "nitrate" is suggestive of caution and calls for investigation to determine if the compound is hazardous. Usually a mineral is the basic element of these compounds, but here we are dealing with a nitrate in which vegetable fibre enters into its composition and we find it in the same category as the dangerous metallic nitrates as regards fire hazard and considerably more dangerous in certain forms as regards explosion hazard.

One form of nitro-cellulose is guncotton, a high explosive used in naval torpedoes, submarine mines, and compounded with fulminate of mercury, nitro-glycerine and other explosives in the manufacture of blasting materials, detonating caps etc. Guncotton is one of the higher nitrates and is ordinary cotton fibre from which all impurities have been removed by boiling with caustic soda to which has been added by the nitrating process above described from 12.6% to 13.4% of nitrogen in chemical combination, while nitro-

(Continued on Page 51)

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## THE HAZARDS IN THE USE OF PYROXYLIN LACQUERS (Continued)

cellulose used in what we may term the peace time industries contains in the neighborhood of from 10.5 per cent to 12 per cent of nitrogen. Except for the nitrogen content the two products are practically identical as to composition, though this slight difference in degree of nitration results in two quite dissimilar compounds as regards physical characteristics, especially as to solubility in certain liquids and stability of the compounds. As regards terminology, it may be stated here that "Pyroxylin" (also sometimes called soluble cotton) is quite generally used synonymously with the term nitro-cellulose, but in a technical sense applies more particularly to lower nitrates used in the manufacture of collodion, pyroxylin lacquers, celluloid, photographic film, artificial silks. As regards the last named product, four commercial processes of manufacture are now in use, all of which use cellulose in some form but in only one of these processes is the cellulose nitrated.

Commercial pyroxylin such as is used in the peace time industries, though in the same general class as guncotton, is not in the same sense or at least to the same degree an explosive. However, it is highly inflammable and under favorable conditions as regards temperature, improper ventilation, confinement in enclosures, or suspended in the air in the form of dust, pyroxylin compounds and the fumes therefrom generated by heat are subject to a severe explosion hazard, as has been conclusively proven both by experience and scientific tests.

Nitro-cellulose, or pyroxylin, is the base of pyroxylin lacquers to which is added coloring matter, a gum or resin binder, a certain quantity of oil known as plasticizer, solvents and thinners. Pyroxylin is soluble only in certain liquids, such as a mixture of alcohol and ether, ethylacetate, butanol, butylacetate, nitro benzene, benzol, acetone, amylacetate, (banana oil) and similar highly volatile, flammable liquids. A cheaper liquid, which must necessarily be highly volatile in order to retain the quick drying characteristic, such as Benzol, is usually used as a thinner. All of these liquids are classed as dangerous under the classification system adopted by the New York Board of Fire Underwriters and as "Red Label" or "Yellow Label" materials under Regulations of the Interstate Commerce Commission for the Transportation of Explosives or other dangerous articles by freight or express. The Red Label indicates that the liquid gives off a flammable vapor at or under a temperature of 80 degrees F., while the

yellow label means that the liquid, while having a flash point higher than 80 degrees F., yields oxygen readily to stimulate combustion of organic matter. All the nitro-cellulose solvents mentioned above except nitro-benzene come in the Red Label class. Nitro benzene is a Yellow Label liquid.

Pyroxylin lacquers therefore involve the combined use of three highly flammable and hazardous substances, viz.: the base, pyroxylin, the solvent and the thinner. The hazard is present in the manufacture and storage as well as in the use of these materials, but as the subject of our discussion refers to the hazards in the "Use" of Pyroxylin lacquers, we shall only suggest the possible increase in hazard in connection with paint factories and in stores carrying stocks of these lacquers and thinners. Such stocks, in various quantities, are now carried by practically all paint, hardware, household goods, automobile supply and similar stores. Although such stocks are in most cases in original containers and there is generally no mixing, pouring nor thinning, yet such a stock if of considerable size, while ordinarily involving no increased causative hazard, may add materially to the combustibility of the general stock of which it is a part and thus be an important factor as affecting loss possibilities. The importance of this hazard in such occupancies of course depends largely on the size of the lacquer and thinner stock carried.

The use of Pyroxylin lacquers is now quite general in all industries where painting and finishing is done, such as automobile factories, automobile paint shops, furniture factories and repair shops, piano factory and refinishing establishments, toy factories, straw hat factories, and is even invading the realm of household use. Disregarding the increased fire hazard, these lacquers have marked advantages over the ordinary paints and varnishes chief among which are ease of application, especially by the spray or "air brush" process and quick drying. In automobile body plants, for illustration, second coats may be applied after only fifteen minutes' drying in air at ordinary temperatures. The method of applying by spraying also greatly expedites the finishing process, so that it is not unusual to apply 3 or 4 coats to an automobile body and have the final coat dry in less than two hours' time, with no artificial means of drying, while formerly it required several days to run an automobile body through the finishing department using ordinary paints and varnishes applied

(Continued on Page 55)

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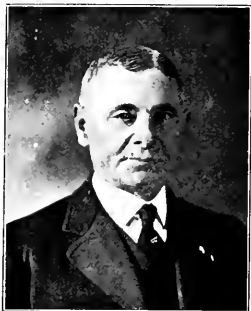


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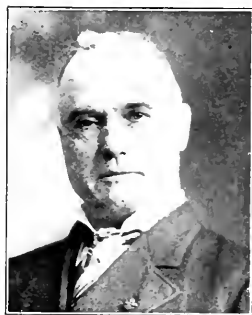
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## THE HAZARDS IN THE USE OF PYROXYLIN LACQUERS (Continued)

with a brush or "flowed on." The color coats required high temperature drying ovens, which are expensive to operate and take up considerable space, while the final varnish coat was dried in the varnish room, which was necessarily of large area and in which a constant temperature had to be maintained for best results. In addition to the higher production efficiency, increased output, saving in time, reduced cost and economy in space with the use of Pyroxylin lacquers, the result is a highly pleasing and durable finish. The same is true as regards finishing of furniture and almost any other article that requires either a color or a natural coating.

Pyroxylin lacquers for other than certain specialized uses are a comparatively new product, developed on a commercial scale since the world war. During the war period enormous sums were invested in emergency plants for the manufacture of smokeless powder, in which nitrated cotton (nitro-cellulose) is the base. At the termination of the war these plants were practically useless for the purpose for which they were built, and chemists set themselves to the task of utilizing them in peace time industry. The DuPonts were probably the most active in their efforts in this direction and the resulting product of that company was placed on the market under the trade name "Duco," probably the best known to the general public at least, of any of the now numerous and widely advertised brands of Pyroxylin lacquers on the market. At the present time practically all of the large paint manufacturers are making and marketing these lacquers under various trade names and labels. The lacquers themselves, as well as numerous air spray devices for their application, are extensively advertised in current periodicals for household use. These lacquers are also manufactured for application with a brush, retaining the same quick drying quality. Brushing lacquers are exploited principally for use in the home. Industries using finishing materials on any appreciable scale were quick to recognize the advantages of these lacquers, applied by spray process, over the finishing methods previously used, and it was only natural that the sudden transition should have introduced new and greater hazards, improperly safeguarded, which in many cases resulted disastrously both to the insured and to insurance companies carrying liability on these risks. In many instances the conversion of the finishing process from the old method to the new was effected at the height of the

heavy production season, the chief consideration being the avoidance of curtailed production, and as a result many make-shift arrangements were resorted to. Furthermore, these industries themselves as well as fire prevention and safety engineers and inspecting and rating bureaus were handicapped by the lack of experience and the absence of any formulated rules or specifications for the installation and use of the new system, so quickly did the process come into general favor.

The National Fire Protection Association and its allied organization, The National Board of Fire Underwriters, following their traditional policy of assisting industry in solving their safety problems and preventing fire waste, immediately assigned their technical staffs to the task of devising ways and means for minimizing this new hazard, with the result that we now have from these sources authoritative information that is proving of inestimable value to the industries and other interests concerned. The National Fire Protection Association has published advanced Committee Reports and also has for distribution a brochure entitled "The Spray Application of Flammable Finishing Materials," and in addition has given considerable publicity to the importance of this hazard as well as educational information concerning it in the Association's current periodicals "The News Letter," "Safeguarding America Against Fire," and "The Quarterly." The National Board of Fire Underwriters has published in the usual pamphlet form "Regulations for Paint Spraying and Spray Booths" and a brochure entitled "Safeguards for Spraying in Connection With Finishing Processes." All this literature is now available to any one interested. Our own Rating Bureau, the Board of Fire Underwriters of the Pacific, has published "Regulations for Paint, Lacquer and Varnish Spraying and Storage."

We shall not go into minute detail in describing the methods of safeguarding the hazards involved in the use of Pyroxylin lacquers, as detailed specifications are available in the literature above referred to. The process and attendant hazards have also been given considerable space and comprehensive treatment in recent books devoted to the subject of fire hazards and prevention. It is more in keeping with the purpose of our discussion to describe the process briefly and to state in general terms the causes that have been responsible for the unfavorable loss experience on risks using this

(Continued on Page 57)

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## THE HAZARDS IN THE USE OF PYROXYLIN LACQUERS (Continued)

finishing process on any extensive scale. First, we may state conclusively that this experience has been very bad, especially in the large industrial centers of the Eastern States and in the earlier stages of development of the process.

The spray process for applying Pyroxylin lacquers and associated apparatus and equipment consists essentially of containers for storing the lacquers and thinners, mixing apparatus for obtaining the proper and uniform consistency of the liquid for use with the "air gun," which latter is simply a modified adaptation of the old and well known perfume atomizer in which the air pressure is applied by an air compressor substituted for the rubber bulb. The "air gun" or "air brush" is usually a glass jar of one quart or less capacity with the atomizing device in the top, including a trigger for controlling the compressed air supply, which latter is connected with the "air gun" by a flexible tube. In small operation the liquid in the air gun is replenished by refilling the glass jar as it is used up. In large operations the glass jar is omitted from the air gun and auxiliary mixing container, up to ten gallons capacity, is used and the liquid is fed into the air gun by gravity, air pressure, or by a pump automatically as it is used. The equipment further includes booths or enclosures for confining the spray mist and vapor to the immediate vicinity of the spraying operation and air or ventilating ducts from the booth to the outside air, together with fans or blowers for forced ventilation of the booths and when necessary the room in which the operation is carried on.

The hazards involved in this finishing process include: first, those incidental to the storage, filling, mixing and thinning of the lacquer, and second, those associated with the application of the lacquer to the article being finished. The first mentioned hazards are easily taken care of by providing for limited storage or detached storage building, together with safe means for filling, thinning and mixing. The same precautions should be used as are customary in the storage and handling of any highly volatile and flammable liquid. The application of the lacquer presents new problems. The lacquer comes from the air brush or gun in the form of a fine mist or vapor, which permeates the entire atmosphere of a room unless preventative measures are employed, thus creating an atmosphere that is either highly combustible in itself or is favorable to combustion and under certain conditions to explosion. Furthermore, it is impossible to localize this mist to the

article being finished, with the result that a residue collects and accumulates on interior surfaces of booths and ventilating ducts, including walls and ceiling of room, unless a properly designed ventilating system is employed. The volatile constituent of this "spray" vapor rapidly evaporates, further adding to the unfavorable atmospheric condition, and the residue or pyroxylin base, of the lacquer, which is highly combustible, is left clinging to such exposed surfaces in accumulating quantity. Booths constructed of incombustible material, together with a properly designed system of forced ventilation with exceptional attention given to cleanliness, are prime requisites to safeguarding this hazard. The booth itself and all ventilating ducts connected therewith should be equipped with automatic sprinklers. If the building is not of fire resistive construction it is also advisable to have the area in the immediate vicinity of the booth sprinklered also, or better still to have the room containing the spray process cut off from surrounding areas and this entire room sprinklered. Means must be provided for keeping the booth, ventilating ducts and any other surfaces on which the spray collects free from accumulation of residue deposit, either by scraping, washing or coating with some material which may be easily scraped off, taking the pyroxylin deposit with it. Caution must be used in scraping to avoid striking a spark. Two ferrous metals should not be used together. It is needless to say that no highly volatile flammable liquid should be used in the washing or cleaning process. Water in liberal quantity is the best for this purpose and this will of course require provision for drainage. The booth should be thoroughly cleaned after each day's work in extensive operations, and in others sufficiently often to keep exposed surfaces reasonably free from deposit. Ventilation, both of the room and of the booth, correctly designed for the individual condition, is one of the most important safeguards. Extraordinary attention to cleanliness is extremely important.

The foregoing safeguards refer to combustibility feature of the hazard. Causes must also be prevented by elimination from the vicinity of the operation of any sparking devices, such as electric switches and spark-producing motors as well as heat producing devices such as hot bearings or electric lamps not properly protected by vapor proof globes or so located that the spray cannot reach the lamp. This may be accomplished by the use

(Continued on Page 59)

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## THE HAZARDS IN THE USE OF PYROXYLIN LACQUERS (Continued)

of reflectors, with the lamps located outside the booth, equipped with vapor tight globes and a sufficient air velocity across the face of the opening in the booth to prevent the spray getting outside. Attention must also be given to the prevention of static discharges, which are usually accompanied by a spark. This may be done by grounding any objects on which a static charge may collect and if a belt is used by enclosing belt and pulley with a casing of conducting metal properly grounded. Sparks may also be produced by friction caused by two ferrous metals striking each other, such as fan blades and air duct casings or booth enclosures made of iron. It is of course preferable to have the finishing department in a separate building, or if this is not feasible, to cut this room off from the rest of the plant so that a fire in this department may not affect large values or other operations.

The degree of this hazard depends in a large measure on the extent of the operation as well as other factors. It would be unreasonable to require the same elaborate installation for spraying in a small occupancy where one device is used only occasionally, in a small building containing small values and involving no great exposure hazard to high value property, as in a large automobile body finishing plant. Safety regulations must be applied within reason, and those promulgated by our properly constituted safety organizations will be found based on an intelligent analysis of individual conditions and situations.

As regards protection in large installations the conventional automatic sprinkler system has proven to be adequate to control the hazard, owing to its flash fire characteristic and the explosive nature of the pyroxylin deposit when exposed to heat. Experiments have recently been conducted using the deluge valve supplying open sprinklers in group arrangement in conjunction with Lowe Automatic Release device with heat actuating units located and arranged to operate to the best advantage. In this system, several open sprinklers are caused to discharge water or other extinguishing fluid simultaneously by the action of one heat unit acting through the Lowe Release mechanism, which in turn operates the deluge valve controlling the supply of the extinguishing liquid. These experiments have been very satisfactory, and it is possible that such installation may in the future take the place of the conventional automatic sprinkler for such specialized uses. The control of hazards associated with this operation also re-

quires the maximum degree of first aid protection.

As regards fire loss record, as we stated above the experience has been bad, especially in the early stages of development of this process. The most conspicuous loss is probably that of the Harper Avenue automobile body plant of the Briggs Manufacturing Company in Detroit, April 23rd, 1927, involving a property loss of approximately \$2,000,000.00 and a considerable loss of life. This was a semi-mill type sprinklered building. The building contained seven double tunnel type metal spray booths. The fire apparently started from the auxiliary equipment of a mercury vapor lamp which ignited some of the accumulated deposit of pyroxylin dust or residue. The first flash was immediately followed by a mild explosion, succeeded by a second explosion which partially wrecked the building and put the sprinkler system out of commission. A report of this fire will be found in the July 1927 issue of the National Fire Protection Association Quarterly. In the same issue will be found a very interesting and instructive article on Lacquer Spraying by Wm. D. Milne, and in addition a summary of typical lacquer fires taken from the N. F. P. A. Department of Fire Record.

While calling attention to the severe hazard attending the use of pyroxylin lacquers with improperly designed equipment and lack of attention to cleanliness, it is not our purpose to paint a dismal picture of the future. It is the speaker's personal opinion that practically all of the disastrous fires that have occurred in which the use of these lacquers was a contributing factor, and the large losses resulting therefrom, have been from preventable causes. We further believe that with properly designed equipment and attention to housekeeping this form of finishing process can be made as safe as the now largely antiquated brushing, flowing and dipping processes. As an illustration of comparative conditions, we recently inspected a large plant making extensive use of pyroxylin lacquers applied by the spray process. We had previously inspected the same plant shortly after the spray process was put into use. At the time of our first visit, conditions reminded us of a dynamite factory. At the base of each spray booth was a commutator type of electric motor for agitating the 10 gallon container. These motors threw off a shower of sparks similar to that produced by grinding a piece of steel on an emery wheel. The motor was attached to a plug

(Continued on Page 61)

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## THE HAZARDS IN THE USE OF PYROXYLIN LACQUERS (Continued)

socket located on the side of the booth, with ordinary lamp cord for the connection. Spark producing switches were located in the same vicinity. Ordinary lamp globes were used in booths, without vapor proof globes. Large drums of gasoline were kept in the immediate vicinity of the booths. The only redeeming features were that the booths and surrounding area were kept clean by scraping down after each day's operation and the system had a fairly good ventilating equipment. This company had experienced no fire during the few weeks' operation with this equipment and when their attention was called to the severe hazards they immediately took steps to remove them.

At the time of our recent visit to the same plant we found all of the above noted severe hazards removed, and three new booths with modern ventilating system had been added to the old revamped equipment. The new equipment makes use of the Venturi principle for exhausting the vapors from the booths, which employs a blower rather than the suction principles. A large Sturdevant blower driven by an electric motor is provided for each ventilating duct, which is vertical and has only a short length inside of building. The blower discharges into this duct above the roof through a tapered discharge pipe, the end of which is at the throat or restricted part of the opening of the ventilating duct. The high air velocity from the blower produces a strong upward draft which keeps the booth as well as the inside of the discharge duct remarkably free from accumulation of lacquer vapor and residue accumulation. The

three booths had been in use about two weeks, during which time it had not been found necessary to scrape them down. It was impossible to detect any trace of deposit at the time of our inspection. This ventilating system is so effective that the characteristic pungent odor of the solvents and thinners used with these lacquers was almost impossible of detection outside of the booths.

We believe that in the future, after a sufficient time has elapsed for a campaign of education and for the correction of defects that found their way into systems installed in the early stages of development, we shall not have to worry so much about the large plant under good management. It will be found more difficult to keep a check on the smaller operations due to their greater number and to the fact that in many instances the new process is substantiated for the old without notification and the change is not discovered until a resurvey by the rating of inspection Bureau or by a Company inspector, is made.

Pyroxylin lacquer spraying is a marked industrial advance in finishing processes and is here to stay. We must recognize this as a fact and face the problem in a sensible manner. Rate penalties for correctable defects should be such as to enforce correction. Net lines should take the hazards of this process into account, which will doubtless in some cases justify cancellation or declination of lines where severe hazards exist and where the insured shows no disposition to minimize them by compliance with reasonable recommendations.

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# New Laws

## IMPORTANT

The following Acts of the Legislature, passed at the 1929 session, are of primary importance to all members of Fire and Police Departments throughout the State.

### Assembly Bill No. 595

#### CHAPTER 260

*In act to add a new section to the Civil Code to be numbered 1714½, relating to negligence upon the part of officers, agents and employees of the state, counties, cities and counties, municipal corporations, school districts, irrigation districts, districts established by law and political subdivisions of the state and authorizing the issuance of insurance covering such liability.*

(Approved by the Governor May 11, 1929.)

*The people of the State of California do enact as follows:*

SECTION 1. A new section is hereby added to the Civil Code to be numbered 1714½ and to read as follows:

1714½. Hereafter the state, and every county, city and county, municipal corporation, irrigation district, school district, district established by law and political subdivision of the state owning any motor vehicle shall be responsible to every person who sustains any damage by reason of death, or injury to person or property as the result of the negligent operation of any said motor vehicle by any officer, agent, or employee or as the result of the negligent operation of any other motor vehicle by any officer, agent or employee when acting within the scope of his office, agency or employment; and such person may sue the state, county, city and county, municipal corporation, irrigation district, school district, district established by law and political subdivision of the state, as the case may be, in any court or competent jurisdiction in this state in the manner directed by law. In every case where a recovery is had under the provisions of this section against the state, any county, city and county, municipal corporation, irrigation district, school district, district established by law and political subdivision of the state shall be subrogated to all the rights of the person injured, against the officer,

agent or employee, as the case may be, and may recover from such officer, agent or employee, the total amount of any judgment and costs recovered against the state, county, city and county, municipal corporation, irrigation district, school district, district established by law and political subdivision of the state in such case, together with costs therein.

And the state, county, city and county, municipal corporation, irrigation district, school district, district established by law and political subdivision of the state may insure their liability in any insurance company authorized to transact the business of such insurance in the State of California, and the premium for such insurance shall be a proper charge against the respective general fund of the state, county, city and county, municipal corporation, irrigation district, school district, district established by law and political subdivision of the state, as the case may be.

This bill was introduced by Hon. Edgar C. Levey, of San Francisco.

### Assembly Bill No. 981

#### CHAPTER 263

*An act to provide for the protection of certain employees of cities, city and counties, incorporated or unincorporated cities, towns or districts, against personal liability incurred while acting within the course of their duty.*

(Approved by the Governor May 11, 1929.)

*The people of the State of California do enact as follows:*

SECTION 1. No member of a fire department or police department maintained by a county, city and county, incorporated or unincorporated city, town or district, shall be held liable in any civil action for damage to persons or property occasioned by any act of such member arising out of the operation, in line of duty, of a motor vehicle of such department while responding to an alarm of fire or an emergency police call.

This bill was introduced by Hon. Harry F. Morrison of San Francisco.



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# "Ten Commandments of the Forest"

Prepared by Fred Stevenot, Director of Natural Resources, State of California

1. Leave no camp fire burning. Stir the coals while soaking them with water. Turn small sticks and drench both sides. Wet the ground around the fire. If water is unavailable stir in dirt and tread it down until packed tight over and around the fire. Be sure the last spark is dead.

2. Throw no burning material away. Break matches in two before throwing them down.

3. Burn no grass or brush without a permit from a fire warden. The state law makes a closed season from May 15 to Oct. 31, during which burning permits are required, but several counties have ordinances requiring burning permits the year round.

4. Build no camp fire within a national forest without a permit from a forest ranger. The state law does not require a permit to build a camp fire outside of national forests, but provides a severe penalty if the camp fire is left burning.

5. Leave trees, shrubs, ferns and flowers as you found them. They belong to all. Leave them for all to enjoy. It is not good forest manners to carve your name on trees or wound them in any way.

6. Destroy no forest signs. They may prevent a fire in your favorite camping spot.

7. Cut no Christmas trees or Christmas berries without written permit from the owner. The state law provides a penalty for acts of this kind.

8. Do not pollute streams. Leave camp sites clean. Bury all garbage. Treat your camp site as you would your own home.

9. Catch no fish out of season. Help the State Fish and Game Commission to keep the streams stocked with fish.

10. Don't kill or molest game out of season. Without wild life our forests would lose much of their charm, and if it is to be conserved, everybody must observe the state game laws.

## ENTERING BURNING BUILDINGS

Should it be necessary to enter a building by window through which flame is bursting so as to prevent, for a time, an entrance being made, the men on the street should direct a stream nearly perpendicular through the window, the water striking the ceiling, spreading around, and making the entrance possible. The officer in charge must make it his business to see that a clear way of retreat is open for the men within the building, and that they are in no danger from falling floors or walls. One man should never be allowed to go alone into a building where a fire has made headway. If the smoke is so dense that the men cannot stand erect for fear of suffocation, a

stratum of fresh air is always to be found a short distance from the floor and they can crawl upon their hands and knees without danger from this cause and with little inconvenience. If danger be apprehended a life-line attached about the waists of the men will enable them to be safely brought out should they become overpowered, and this simple precaution need never be omitted. In leaving the window and going toward seat of fire, be sure that pathway toward window is clear. Be careful when breaking glass windows, the main precaution being to stand to one side when cracking plate glass and be sure the men are out of the danger zone below.

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# Questions

Questions asked at an examination for Battalion Chiefs in an Eastern city and the key answers for same.

## Questions

1. State how you would supervise a battalion giving attention to discipline and co-operation among the officers.

2. Describe fully the hazards attending fires in the following plants, and state how you would handle such hazards.

- (A) Baled rags.
- (B) Paint and varnish.
- (C) Dyeing and cleaning.

3. A fire occurs in an 8-story hotel of semi-fireproof construction at 3 a. m. When you arrive on the scene you learn that the fire is on the 6th floor and that smoke is coming out of the windows. The fire is located in a room in the center of the above floor. There are two 4-inch standpipes, one in the front and one in the rear of the building. There is one elevator located about in the center of the building. State fully what you would do if you were in charge of the fire for twenty minutes after your arrival.

## Answers

1. A battalion chief is at all times responsible for the efficiency and discipline of men under his command. To insure the greatest efficiency, it is necessary that he supervise personally the work of his subordinates at stations and on fire ground, and also that he have first hand knowledge of the hazards of his district. To insure discipline it is necessary that he be strict, but at the same time impartial. He must see that justice is done in every case. If he can obtain a high degree of efficiency and discipline without resorting to the Board of Trial so much the better. However, when an offense or breach of discipline warrants it, he must prepare a report for the Chief making specific charges against those concerned.

In such cases he will also recommend the suspension of the offender. However, the most important step in maintaining discipline in fire companies is by company inspections. These inspections to be made at least twice a week. Such inspections should include a thorough survey of the building, equipment and personnel. Also a check-up on the company's journal.

The inspections must necessarily take into account the uniforms of the men—the condition of

the uniforms and their style—whether of the standard or of non-standard design.

In administering discipline it is absolutely essential that no partiality be shown whether in granting time off or in assigning work in the various stations; this point must be foremost in mind. Be firm but fair. Permit no laxity—no deviation from the rules.

To increase co-operation among officers, means of co-operation must be pointed to the officers on inspection or at other times. Instances of failure to co-operate or to work in harmony must be called to the attention of company commanders. But this must be done quietly and in the presence of the offending officer only. Nothing breaks discipline down quicker than to criticize an officer in the presence of his men. Make it clear to the company officers that the first officer at a fire has complete command until a superior officer arrives. Make it clear that such officers arriving first at a fire must have the respect and obedience to which a superior officer is entitled.

Instruction of the captains in way to co-operate and in the methods of handling fires will go a long way toward developing the co-operation desired.

2. (A) Three special hazards are incidental to fires occurring in baled rags. They are: 1. Absorbing by the rags of a great quantity of water which may cause the collapse of floors; 2. Swelling of the bales of rags when wetted and structural damage to the building and floor collapse as a result; 3. Fire burning concealed in the center of bale after fire on the outside has apparently been extinguished.

In handling fires wherein baled rags are present, no more water than necessary should be used on the bales. Careful use of water will prevent the swelling of the bales as well as possible collapse of floors due to bales absorbing great quantities of water. After fire has been extinguished bales should be opened up to make sure that no fire is still burning on the inside.

(B) In addition to the usual hazard incidental to fires in inflammable liquids, two special hazards are encountered at paint and varnish fires. The first of these is the possibility of explosion of inflammable vapors which are thrown off by paint and varnish when heated. The second is the possibility of paint and varnish flowing when afire and thereby spreading the fire. When handling fires in paint and varnish establishments, thorough ventilation should be provided at once. Water should be used carefully so as not to enter

(Continued on Page 73)

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## QUESTIONS (Continued)

containers filled with these inflammable liquids. If the varnish vats are afire, water thrown in them may cause the varnish to be scattered in all directions and it may also cause the varnish to overflow, by filling up the vat. Such varnish when overflowing may carry the fire down stairs or along other channels.

Use foam extinguishers wherever possible on paint and varnish fires. Foam produced by these extinguishers floats on the surface and neither causes the paint to overflow nor scatters the burning fluid in all directions when the foam strikes the liquid as in the case of water. Water is used largely in cooling down vessels containing burning paints and varnishes. In so using streams, take care that water does not unnecessarily enter vessels.

(C) Dyeing and cleaning establishments are distinguished by the presence of volatile inflammables such as benzine, gasoline, etc.

Dry cleaning plants are apt to have on hand great quantities of highly inflammable liquids and frequently in open containers where garments are washed. These inflammable liquids mean explosive gases.

In fighting a fire around such an establishment, first provide thorough ventilation, then use foam apparatus if it is available. If water is to be employed, use it largely to wet down walls and to cool off containers in which inflammable liquids are kept. If foam apparatus is not at hand, then water must be used in very liberal quantities to break the fire and drench it out.

3. Fire occurring at 3 o'clock in the morning in an 8-story hotel building would represent a very severe life hazard. The fire is burning near the corner of the building and smoke is coming out of the windows on the street which would indicate a direct source of communication from the center of the building to the windows. This would mean that fire would quickly spread from the center of the building through the building to the street front thereof.

Response will be assumed to be 3 engine companies and two truck companies on the first alarm.

As the fire is burning near the center of the building, and as the elevator shaft is located at the center, this would mean that the fire is in the neighborhood of the elevator shaft. There is danger of it entering the shaft and quickly spreading to the upper floors.

Due to the extreme life hazard, upon arriving additional alarms should be transmitted at once, preferably second and third alarms.

The fact that the fire is burning near the ele-

vator shaft would mean that the elevator service will soon be out of commission.

As the halls in the building must reach the elevator shaft, fire burning around the shaft will have available means for traveling throughout the entire floor. If fire enters the shaft and goes upward it will leave the shaft and travel throughout the various floors on its way up.

Assignment of apparatus on the first alarm, and the action to be taken otherwise would be as follows:

First sound the hotel fire alarm if such is available and if such has not already been done.

Send members of the first fire truck company through the building to arouse the guests and to show them to safety by means of stairways. Problem does not state how many stairways are available but it is likely in a building of this sort that two will be at hand.

In view of the fact that fire is still burning in the center of the building, either or both of these stairways will be available for the escape of the guests, provided the fire is held.

Have two members of first truck company go to the roof at once to open up over elevator shaft so that fire will be drawn out of this channel and will not mushroom on the upper floors.

Second truck company to assist first truck company in getting the guests out of the hotel and raising ladders for use by engine companies.

First engine company go up into building by means of elevator, if it is still available for use, to the fire floor, connect a line to the 4 inch standpipe at front or rear of building and stretch line to fire.

Second engine company also go up to the fire floor and utilize other 4 inch standpipe with fire department line of hose.

These two engine companies, if fire does not force them to retreat, can hold the fire from spreading until the building can be emptied.

As the problem seems to infer, fire must have gained considerable headway to be discharging smoke from the windows at the front of the building. If this is the case, it may not be possible to utilize either or both of the standpipes on the fire floor. If such is the case the engine companies should stretch their lines from the floor below the fire floor up stairways to the fire.

The third and fourth engine companies go to the 4th floor and each stretch a line by means of stairways to the fire floor. This will give four streams on the fire from the two four inch standpipes.

One engine to be so stationed as to supply each standpipe.

(Continued on Page 75)

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## QUESTIONS (Continued)

Upon the arrival of the first apparatus on the second and third alarm companies, assignment will be made as follows:

Line stretched by ladders or fire escapes up to fire floor both front and rear; lines stretched by fire escape or ladders to floor above fire floor to check fire from spreading on this floor from the shaft.

Additional truck companies arriving to make a survey of the building to make sure that fire has not dropped through vertical shafts or is not spreading through channels which may have been overlooked by the first companies on hand.

It is most essential that either or both of the stairways be saved for use by the guests in the hotel. This point should be firmly borne in mind when the first companies are put to work.

If it is found upon arrival that fire is spreading toward either or both of the stairways, lines should be stretched from floors below to cover these points.

The first consideration is always the saving of life, and only after life has been saved should the department devote its energies to bringing the fire under control.

Apparatus of ladder companies responding with the second and third alarm should be so placed as to enable the engine companies to get lines in on the fire floor and the floor above. There will not be such great danger from fire dropping to the floors below because lines can easily cover these points. The spread of the fire to the floors above is the most serious means through which the blaze may extend. These must be covered first.

In the event that fire is getting away from the department no time should be lost in transmitting additional alarms.

But in view of the fact that the fire is apparently confined to a comparatively small portion of the building it is believed that a three alarm assignment can easily handle the blaze.



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VIEW OF THE SOMMER & KAUFMANN FIRE—ELLIS STREET SIDE

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# Uses of Carbon Tetrachloride

Carbon tetrachloride is especially suitable as an extinguishing agent for use on flammable liquid fires due to the fact that it is very volatile and in the gaseous state is about two and five-tenths times as heavy as air. When applied on this kind of a fire the stream of carbon tetrachloride should be directed against the side of the container just above the flammable liquid, in order that it may vaporize the more readily and the gas be permitted to spread over the burning surface, excluding the air. Should the stream of carbon tetrachloride be directed into the flammable liquid, a good part of it would sink because of its high specific gravity and have no effect as an extinguishing agent.

Because of its nonconducting property and due to the fact that it has no injurious effect upon such equipment, carbon tetrachloride used in extinguishers labeled by Underwriters' Laboratories is especially suitable as a fire extinguishing agent for use on electrical equipment fires. While it is of course desirable to shut off the current when attacking an electrical fire, this may not always be possible, and in such a case carbon tetrachloride may be used on the electrical equipment without any detrimental effect on either moving parts or stationary parts.

Carbon tetrachloride used in first-aid extinguishers labeled by Underwriters Laboratories is especially treated to remove impurities and contains an important component for depressing the freezing point of  $-50^{\circ}$  F. Extinguishers employing this special liquid as the extinguishing agent do not require protection against freezing.

The one and one and one-half quart carbon tetrachloride extinguishers labeled by Underwriters' Laboratories are provided with a hand operated pump and require pumping during operation. The one quart device is especially suitable for use in garages, in boiler rooms where oil burners are employed, and on automobiles and motor boats. The one and one-half quart machines are especially suitable for use in industrial plants where they will be operated by men. These appliances are given a classification of B-2, C-2, two machines constituting a unit of first-aid fire protection on either Class B or C fires. They should be partially discharged and refilled yearly, whether used or not, to insure easy working ac-

tion of the pump. Only the special recharges obtained from the manufacturer of the device should be used and under no circumstances should water be poured into the device. Water or carbon tetrachloride not specially prepared might result in corrosion of the pump parts, rendering the extinguisher unserviceable.

The one gallon carbon tetrachloride extinguishers labeled by Underwriters' Laboratories consist essentially of a liquid chamber, a compressed air chamber and a hand pump. The air chamber is normally under a pressure of 100 pounds per square inch, which may be re-established by means of the attached pump. The extinguisher is operated by opening a valve which allows the compressed air to enter the liquid chamber resulting in the discharge of the liquid through a hose and nozzle.

The one gallon carbon tetrachloride extinguishers are intended for special use in electrical power stations and industrial establishments where consideration is given to the great amount of liquid employed and where they will be operated by experienced men. Where these extinguishers are used it is necessary to take precautions to protect the user from the toxic effects of the vapors formed. Persons who might be called upon to use these appliances should be familiar with their use and operation, and should be instructed in regard to the hazard involved. An ordinary gas mask, such as were used during the recent war, provides a very convenient and effective means of protecting the operator from the gases formed when the carbon tetrachloride is played on a fire. These extinguishers are given a classification of B-2 by Underwriters' Laboratories for the reason that they are not capable of controlling as large fires in flammable liquids as the two and one-half gallon foam extinguisher; and a classification of C-1 because of the large quantity of non-conducting liquid employed as the extinguishing agent.

These extinguishers should be inspected periodically to determine whether the air pressure is maintained and the pressure should be re-established to 100 pounds per square inch when necessary. Only special carbon tetrachloride obtained from the manufacturer of the extinguisher should be used for recharging.

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SAN FRANCISCO'S FIRE PREVENTION STAFF

Courtesy "The Municipal Employee"

Reading from left to right: Harold E. Robbie, Inspector; Lawrence H. Casserly, Inspector; Jacob H. Moll, Inspector; James H. Foye, Inspector; William A. Bullier, Inspector; Daniel J. McKenna, Inspector; Theodore Trivett, Captain in charge; John M. Prudden, Clerk; Jesse H. McLendon, Secretary; Lt. Henry Casper, Fire Commissioners' office; Lt. Benedict J. Newel, Chief Inspector.

That an ounce of prevention is worth a pound of cure has been conceded for ages. That "Fire Prevention" might be worth something has been conceded only a few years. For many years, the ever increasing fire losses were viewed with alarm. Slowly the people began to realize that something must be done to prevent this tremendous waste. Sporadic efforts were made by organizations, fire departments, schools, etc., to lessen the fire losses by inspections, appeals to the public through the daily press, and addresses by public speakers. While all of this undoubtedly served a good purpose, the losses continued to increase until the astounding figure of \$360,548,624 was reached in the year 1926. Thinking people then concluded that a different and systematic method of prevention would have to be inaugurated. Since the tremendous sum of \$500,000,000 in annual fire losses is eventually paid by the citizen and constitutes a direct tax upon his income, logic pointed to the municipality as the proper agency to reduce the fire losses. Where moral persuasion alone had failed, compulsion might achieve results. Thus the idea of the Municipal Fire Prevention Bureau was conceived, and took shape in the form of an organization of trained fire inspectors backed by adequate laws and ordinances and the power to enforce them. As the Police Department of the Municipality

is charged with the duty of combating the thief and the other enemies of society, so is the Fire Prevention Bureau charged with the duty of combating "FIRE" and the persons who through carelessness or neglect encourage "FIRE," the common enemy of us all.

With the idea of the Municipal Fire Prevention Bureau materialized, it became necessary to develop ways of reducing the fire losses. The means of combating fire essential to a Fire Prevention Bureau were found to be of various kinds: "Adequate laws and ordinances enacted with a view toward 'Fire Prevention and Fire Protection,' systematic inspections of all buildings as to possible hazards and their removal, dissemination of fire prevention knowledge, and the education of all classes and ages in the necessity of practicing 'Fire Prevention.'"

San Francisco's first official efforts in "Fire Prevention" were made in June, 1920, when Ordinance No. 5185, creating a Bureau of Fire Prevention and Public Safety, was approved. The Bureau, as created, was composed of the Chief Engineer of the Fire Department, Fire Marshal, Chief Inspector of the Bureau of Building Inspection of the Board of Public Works, Chief of the Department of Electricity, Chief of Police and

(Continued on Page 83)

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## FIRE PREVENTION AND PUBLIC SAFETY (Continued)

Health Officer. The Bureau was given the power to enter and inspect all buildings within the City and County of San Francisco, and wherever hazardous conditions or violations of the law were found to exist, it was charged with the duty of having them corrected. Ordinance No. 5185 charged the heads of the different Departments to give the Bureau every possible aid, and, if necessary, to detail men of their own personnel to the services of the Bureau.

While other cities of equal size built up their Fire Prevention Bureaus to a point where much good resulted from their activities, San Francisco's Bureau lay practically dormant until the beginning of the year 1928. At that time, the Junior Chamber of Commerce, through their Fire Committee, began a detailed study of fire conditions throughout the City. The Fire Department as a fire extinguishing agency was found to compare favorably with the best in the United States. The Bureau of Fire Prevention, however, was found to be measurably inferior to the Bureaus of cities of less than half our population.

Without any other motive except to give service, and in a spirit of civic pride, they began action to remedy this condition. Fortunately, in the present Board of Fire Commissioners, composed of able and progressive men, they found a staunch ally. Through the combined efforts of the Board of Fire Commissioners and the Fire Committee of the Junior Chamber of Commerce, the first appropriation for "Fire Prevention" was made in the 1928-29 budget, and, on July 1, 1928, under the supervision of the Board of Fire Commissioners, the Bureau was completely reorganized. Captain Theodore Trivett was placed in

charge and seven new Inspectors were added to the personnel. The new Inspectors were selected by competitive examination from among the members of the Fire Department with over five years service. Their records in the Department, special aptitude, previous employment, personal appearance and education were considered in the examination. After selection, the Inspectors were required to obtain a knowledge of the Building Laws and Ordinances of the City and State, knowledge of actual and potential fire hazards, and the protective and corrective measures to be applied. Their positions then became permanent, pending satisfactory service.

The work performed by the Bureau during the year beginning July 1, 1928 and ending June 30, 1929, is as follows:

Total number of Inspections .....	9535
Total number of Re-inspections .....	5355
Total number of Violations .....	8051
Total number of Corrections .....	5562

The record speaks for itself. The dollar and cent value of prevented fire losses unfortunately can not be shown, inasmuch as the losses are not published in San Francisco, and also only small portions of the City have had the benefit of regular and systematic inspections. In the small portions of the City inspected, however, the Bureau can show that the number of fire alarms and the fire service has been reduced approximately 5 percent. The Board of Supervisors appropriated in the 1929-30 budget sufficient money to give the Bureau an additional seven Inspectors. With its increased personnel, the Bureau plans to give the entire City the protection of regular and systematic inspections.

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# Fire Extinguishment Methods

It is not often that the average layman, the man in business, the citizen of your community, pays much attention to the fire department. It is very seldom that they think of you and if a thought does come it is a fleeting one, except in the time of necessity, when a man's house or his place of business is on fire, and then he gives a great deal of thought and attention to the fire department; but until that time comes you are not in his mind perhaps as much as you should be.

He does not realize that your business has become very scientific, in a degree, I might say, almost as scientific as that of the physician or any of the sciences. The old haphazard method of fire extinguishment is passe, they are not doing much of that any more. You are employing different methods than those used a few years ago. The best example of that, I might say, is the great improvements that have been made from a purely scientific standpoint in the matter of equipment. Fire apparatus today compared with that of a few years ago is much finer, much more effective in its work. However, if mechanically perfect machines and faultless fire alarm systems were all that is necessary to constitute efficiency in a fire department, many cities would be perfect in this respect, but while these improvements, involving the expenditure of thousands of dollars, are very necessary, there is a third or human element which is the most important factor. The mechanical equipment can go only so far in the extinguishment of fires. The personnel of the department is a far more important factor. For that reason every man in the department must be well trained, active and capable of filling his position in such a manner that it will not be detrimental to the functioning of the department. For this reason the modern drill school or the fire college has been instituted in a great many of our fire departments.

I do not think it would be amiss to mention the four major parts. The first might be termed practical hydraulics, which has to do with fire, smoke, back pressure, etc. If a man is trained to know what the limits are and what is most effective in this important branch of fire service, his work as a matter of course is more effective than if he were going at it blindly.

The second division I will term the chemistry of fire, which has to do with causes and effects. Those things are very necessary in fire prevention work—inspections by uniformed members of the fire department—for the reason if you will inspect a place of business where the stock in trade might be of a dangerous combustible nature, capable of starting fires by spontaneous combustion, it is well for you to have some knowledge of the chemistry

of fire in order that these various commodities might be segregated or properly safeguarded. I do not mean you should have a degree in chemistry or a degree in hydraulic engineering. I do not mean that at all, but there are certain fundamental principles involved that every fireman to be efficient should become more or less familiar with in order that he can do the things so necessary in these inspections.

This chemistry of fire treats exhaustively on the subject of oxidation, slow burning. It is nothing more or less than a slow process of burning. If we had two blocks of wood as nearly identical as possible and we would place one in a furnace and burn it, we all know a certain amount of heat would be generated by the consumption of that block of wood. If the other block so nearly the same size as the first one was placed on the ground and exposed to the elements, it would in time disappear until nothing but a small residue or ash is left. Exactly the same amount of heat has been generated by the piece of wood laid on the ground as the one placed in the furnace, the only difference being in the point of time consumed in this operation.

The chemistry of fire also applies to the subject of gas masks, proper masks to use under certain conditions. It treats proper types of chemical extinguishers to use under certain conditions, which is really a science in itself.

Now, coming down to the third division of the modern fire college, we will call it the drill school of evolution, which has to do with the proper handling of all equipment. The statement was made that not many men could properly name every piece of equipment carried on the ordinary aerial truck and I believe that statement to be absolutely true. I doubt very much if there are more than a very small number of men who could go to a service truck or aerial truck and pick up every piece of equipment carried on that truck, give its proper name and tell how it could be used most effectively.

This training school or school of evolution, has to do with that phase of the work, the proper handling of all apparatus and equipment, its use and why. A very effective thing. It standardizes the work of the men so that when two or more men are used in any single evolution every man knows exactly what is expected of him. He furthermore knows exactly what is expected of the other fellow. He knows exactly what the other fellow is going to do and by a coordination of effort you accomplish results with a minimum amount of energy expended.

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Remains to save when hope itself is gone;  
When all have fled, when all but he would fly,  
The Fireman comes to rescue or to die.*

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Grover T. Lane.....	Sept. 11, 1928
Henry J. Brown.....	Sept. 19, 1928
James J. Mullaly.....	Oct. 17, 1928
Frederick W. Sayers.....	Nov. 22, 1928
William C. Viereck.....	Dec. 10, 1928
Joseph L. Tracy.....	Jan. 3, 1929
Walter J. Seaman.....	Feb. 18, 1929
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In 1900 the City of San Francisco adopted a Charter which called for some radical changes in the city government, and one of which was to create a Department of Electricity, under the control of a joint board composed of the members of the Boards of Fire and Police Commissioners. This department took over the complete control of the Fire Alarm and Police Signal Systems, besides being charged with the supervision and inspection of all electrical work in all old and new buildings, and all overhead wires.

The original location of the Fire Alarm System and its auxiliaries was in Brenham Place, a small street running from Sacramento Street to Clay Street and between Kearny and Dupont Streets, in quarters formerly occupied by Monumental Engine No. 6 of the San Francisco Volunteer Fire Department, and after the dissolution of the Volunteer Department used as the headquarters of the Exempts. The Fire Alarm System used the upper floors and on the roof was a large bell which sounded all the alarms.

After the fire of 1906 which destroyed this old building it became evident that the Fire Alarm Station should be placed in a fireproof building and one that would be absolutely free from all danger of fire from surrounding property, and it was decided that Jefferson Square would be an ideal location, so a one-story and basement Class A building was constructed in the Square, on Turk Street, between Octavia and Laguna Streets, and was occupied as a Central

Fire Alarm Station on February 28, 1915. All its equipment was manufactured and installed by the employees of the department, and the system in service is deemed to be one of the most efficient and up-to-date in the United States, and tests show that the average time between the citizen pulling in the Fire Alarm Box and the fire apparatus starting to roll to the fire is 23 seconds.

The fire alarm switchboard is semi-circular in shape, with front composed of four different colored sections of marble, and the back of the board is enclosed by metal cabinet doors. All wires of the system enter the building underground with a very extensive underground terminal rack in the basement of the building, it being the terminus of fire alarm circuits, telephone exchange, traffic signal circuits, and other miscellaneous features operated to and from this office. There are now in operation 1185 Fire Alarm Boxes, connected on fifty-four signal circuits, and twenty-two tapper and joker circuits for transmission of alarms and joker signals to fire department quarters.

During the fiscal year ending June 30th, 1929, nearly 8000 fire alarms were received and transmitted to the Fire Department, and over 30,000 other signals were handled over the joker circuits.

The following table of alarms received and sent out during the past ten years will give an idea of the work of the department in that regard:

Comparative Statement of Alarms Received July 1st, 1919 to June 30, 1929

ALARMS	1919-20	1920-21	1921-22	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29
1st .....	2107	2146	2347	2554	2996	2493	2723	2758	2978	2977
2nd .....	61	60	58	55	60	62	60	77	54	69
3rd .....	26	23	31	24	26	28	22	31	13	21
4th .....	4	6	3	5	2	5	2	4	1	1
5th .....	3	1	1	0	0	1	0	0	1	0
6th .....	1	1	0	0	0	0	0	0	0	0
Stills .....	2350	2620	2920	3096	4063	2979	3622	3740	4117	4706
	4552	4837	5360	5734	7147	5568	6429	6610	7163	7774



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### CAPTAIN TO BATTALION CHIEF

(List adopted June 15, 1927, to run five years)

1	79.892	George A. Nolan.....	100 Onondaga Avenue
2	79.812	Coleman J. Conroy.....	70 Homestead Street
2½	79.673	Thomas E. Kenney.....	11 Eugenia Avenue
3	79.606	Thomas J. Keohane.....	767 Twenty-fifth Avenue
4	79.585	Michael Rudonick.....	2245 Larkin Street
5	79.25	Walter D. Griffin.....	2832 Irving Street
6	77.527	George F. Schaefer.....	3372 Sacramento Street
7	77.345	Michael J. Flaherty.....	351 Tenth Avenue
8	77.107	John Mahoney.....	816 York Street
9	76.313	George H. Murray.....	3372 Sacramento Street
10	76.105	George L. Trapp.....	3774 Twenty-fourth Street

### LIEUTENANT TO CAPTAIN

(List adopted June 13, 1927, to run four years)

Rank	Weighted	Name	Address
1	6967.8	John K. Bray.....	152 Hartford Street
2	6868.8	Lawrence J. Dwyer.....	439 Haight Street
3	6836	William Van Dervort.....	2420 Howard Street
4	6817.2	Edward M. O'Donnell.....	635 Castro Street
5	6812	Henry C. Kolby.....	2138 Twenty-third Street
6	6803.6	Erwin G. O'Meara.....	1401 Plymouth Avenue
7	6778	Melville S. Munter.....	631 Arguello Boulevard
8	6698.3	Walter J. McKenna.....	173 Ellington Avenue
9	6652.2	Henry Dieckmann.....	369 Liberty Street
10	6626.3	Carl F. Kruger.....	1236 Chestnut Street
11	6561.8	John J. Hartford.....	194 Borica Street
12	6452	Jeremiah A. Riddell.....	2328 Lombard Street
13	6429.6	Adolph P. Penesky.....	4069 Twenty-sixth Street
14	6410.3	Frederick E. Jones.....	2359 Fifteenth Avenue
15	6340	Frank W. Theobald.....	535 Twenty-fourth Avenue
16	6312.8	John T. Gaffney.....	966 Vienna Street
17	6299.2	Charles F. Lennon.....	133 Parker Avenue
18	6263.8	Cornelius C. Sullivan.....	359 Valley Street
19	6187.1	Hugh J. Carr.....	3154½ Mission Street
20	5607.4	Angel F. Soto.....	516 Sanchez Street
21	5571.1	Victor C. Dupuis.....	

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2	6120.1	Otto B. Metz.....	81 Downey Street
3	6059.4	John F. McCook.....	1699 Oak Street
4	6017.7	Melville H. Miller.....	328 Staples Avenue
5	6016.4	James R. Gavin.....	25 Linda Avenue
6	5990	Oscar F. Postel.....	962 Oak Street
7	5981.4	John F. McElearney.....	2330 Thirtieth Avenue
8	5966.4	John M. Wall.....	442 London Street
9	5962.4	John Koster.....	2442 Howard Street
10	5956	Andrew J. Clancy.....	2653 Howard Street
11	5860.8	George Maegling.....	1300 Twelfth Avenue
12	5824.5	Edward F. Jake.....	878 Forty-seventh Avenue
13	5816.7	Thomas F. Ryan.....	975 Athens Street
14	5782.3	Francis J. Pearce.....	75 Crescio Court
15	5774.6	Charles J. Egan.....	245 Dorland Street
16	5705.4	Alexander Strang.....	205 Twenty-eighth Street
17	5514.6	Clarence J. Dunlavy.....	1487 Seventeenth Avenue
18	5463	Dante J. Darini.....	2711 Bryant Street
19	5424.3	Joseph F. McCarthy.....	173 Sears Street
20	5313.8	Ralph M. Pierini.....	1515 Taylor Street
21	5311.4	William Hillebrandt.....	1462 Newcomb Avenue
22	5176.8	John T. Hutchison.....	3727 Army Street
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**QUESTION**—Mention the four most common causes of spontaneous combustion.

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Second: Vegetable fibre, when baled or when in piles and allowed to be dampened and not properly cured before baling.

Third: Chemicals containing ingredients which, when mixed by leakage, breakage, or in the use of water may cause a rapid combustion or explosion.

Fourth: Dust allowed to collect, such as in flour mills, storage rooms, candy factories, glucose and starch works, grain elevators, etc.

Note: These four common causes are the ones mostly met with by the members of the Fire Department. There are many other causes of spontaneous combustion, some produced by bacteria, others by oxidation, etc.

While I believe that the foregoing fairly answers the question and might be rated as worth anywhere from 95 to 100 per cent for the ordinary fireman, it is not by any means a complete exposition of combustion or what it means. I therefore presume upon your space to give a clearer and more definite explanation of what combustion is, in the hope that it may benefit the rising generation of chief officers in the Fire Department.

**Combustion:** Combustion in the strict sense is oxidation, but commonly speaking, it is rapid oxidation or oxidation accompanied by heat and light, or, in its popular sense, is the union of a substance with oxygen. The amount of heat depends upon the quantity of oxygen which enters into combination, and the intensity of the heat depends upon the rapidity with which the fuel unites with the oxygen. When this combination takes place slowly, as when iron oxidizes in the air, the heat produced is imperceptible, but if it takes place rapidly the disengagement of heat is very intense. The same quantity of heat is produced in both cases, but when it is produced slowly it is dissipated as fast as formed.

Many combustibles burn with flame. A flame is a gas or vapor raised to high temperature by combustion. Its illuminating power varies with the nature of the product formed.

**Ignition Point:** Although oxygen unites at all temperatures, yet combustion does not commence until the heat of the combustible is raised to a

certain point, when we say "it has caught fire." The burning point of any substance is the temperature at which it bursts into quick combustion. We elevate the heat of a small portion to the point of rapid union, with oxygen, and that part in burning will give off heat enough to support the combustion of the rest.

**Example:** In making a fire, we take paper or shavings which, being poor conductors of heat, in exposing a large surface to the action of oxygen, are easily raised to the required temperature. We thus obtain heat enough to start the combustion of chips or pine sticks, and gradually increase the quantity of heat until there is enough to ignite the coal or wood.

The temperature at which rapid combustion may take place differs with different bodies. Thus, in atmospheric air, phosphorus ignites at 150 degrees Fahr., sulphur at 1,000 degrees Fahr. Wood, coal, oil, tallow, etc., consist mainly of carbon and hydrogen, and are therefore called hydrocarbons.

**Slow Combustions:** Oxygen as well as other elements frequently enters into slow combustion at ordinary temperatures and without perceptible heat, as in the rusting of iron in the air. However, heat always accompanies this slow form of combustion: An ounce of iron rusted in air or burnt in oxygen produces the same amount of heat, but in the former case it requires hours for its development and in the latter only as many minutes.

**Spontaneous Combustion:** Sometimes chemical changes take place in combustible substances whereby heat enough is generated to cause combustion. This is most liable to occur with porous substances which expose a large surface to the air. The tow or cotton waste used for wiping the oil from machinery and then laid away in the heat often ignites in this manner. Lime occasionally absorbs H<sub>2</sub>O (water) so as to set fire to wood in contact with it. Fresh burnt charcoal has the power of absorbing gases in its pores so vigorously as to become ignited.

**Explosive Combustion:** When two gaseous bodies, combustible in each other, are mixed and ignited, an explosion ensues. This is because the constituent parts of the gaseous mixture are so intensely blended that the heat evolved by the particles first ignited passes to those adjoining and so on to the entire mass, with such velocity as to cause an almost instantaneous completion of the process. The products of this form of combustion are always in the form of highly expanded

(Continued on Page 99)

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## QUESTIONS AND ANSWERS (Continued)

gases or vapors, the intense refraction of which gives rise to a vacuum and the particles of air rushing in to fill this, in colliding with each other produce the noise and often the effect of an explosion (back draught).

**Chemistry of a Fire:** All our fuels and lights consist mainly of carbon and hydrogen. In burning they unite with the oxygen of the air, forming water and carbon dioxide. These both pass off, the one as a vapor, the other as a gas. In a long stovepipe, the water sometimes condenses and drips down, bringing soot down upon the floors of our apartments. No matter how rapidly the fire burns in the blaze of the fiercest conflagration, the elements unite in exact chemical equivalents. The products of combustion are (a) physical heat and light and (b) chemical water and carbon dioxide, the result of hydrogen and carbon burning in the presence of oxygen.

**Extinguishment of Fires:** Blowing on a lighted candle or lamp extinguishes the flame because it lowers the heat of the flame below the point of union of carbon with oxygen. Fires are put out by water partly for the same reason and also because it envelops the wood or other combustible material and shuts off the air. This smothers the fire by shutting out the oxygen of the air upon which it feeds.

**QUESTION—**What are the dangers to be guarded against while fighting a fire involving wool or paper in quantities, ammonia and non-explosive oils?

**ANSWER—**Wool and paper stock absorb and retain water, and in so doing expand considerably in volume and increase in weight. If possible, fires in wool and paper stock should be extinguished with the least possible amount of water, but in cases where it is necessary to use a large volume of water to extinguish the fire, it should be kept in mind that a great portion of this water is retained in the wool or paper stock thereby increasing the weight on floors, also the expanding of the wool or paper stock caused by the absorption of water is liable to distend the walls, floors and ceilings, and that the building is liable to collapse from either cause.

Liquified ammonia is dangerous on account of the high pressure developed on the application of gentle heat. At a temperature of 112 degrees Fahr., liquified ammonia will generate a gas which expands to a pressure of 1,000 pounds to the square inch. It is therefore important, in case of fire, to promptly empty the pipes to the storage containers, ventilate the building, cover the fire with

water, at the same time cooling down all pipes through which the liquified ammonia passes and to dilute any of the free or liquid ammonia with large quantities of water. If ammonia gas is passed over a hot fire or escapes into a hot fire, oxohydrogen is formed, which, coming into contact or uniting with the oxygen in the air, forms a highly explosive oxyhydrogen gas. The fumes of ammonia are suffocating and destroy the tissues of the respiratory organs, causing death in a very short time. In fires where ammonia is present, it is important to ventilate properly, to free all pipes from ammonia gas by returning same to the storage tanks, to use large volumes of water to cool down the building and to dilute the ammonia.

By the term non-explosive oils, I understand non-volatile inflammable oils, oils which do not give off inflammable vapors below 100 degrees Fahr., and do not exhibit explosive risks under the temperature of 400 degrees Fahr.

The chief dangers in fires where the non-explosive oils are stored are:

(1st) From permitting them to permeate or come in contact with other substances. They impart to these latter a great tendency to inflammability. Fibres and similar substances even become liable to take fire spontaneously under these conditions.

(2nd) They help greatly to spread flame and transmit it to other substances, since these fats or non-explosive oils melt at a low temperature so as to become liquified.

(3rd) The burning fats and oils generate great heat and are difficult to extinguish.

(4th) The intense heat may cause masses of the oil or fat to liberate explosive vapors. Burning masses of oil or fat will erupt and throw the burning material about.

The use of water in extinguishing fires of this kind acts as a carrier and facilitates the spread of the fire, if not properly directed. The quenching action of the water is very slight owing to the intense heat liberated by these substances when burning. Water should be used with extreme care, and every precaution taken to prevent the spread of the burning oils.

It is important at such fires to keep all surrounding vessels, tanks or containers, of oil, cool by the use of large volumes of water. Water should never be thrown into a vessel, tank, or container, of oil, which is on fire.

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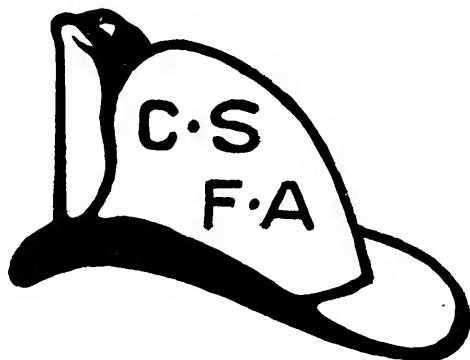
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# California State Firemen's Association



THE Seventh Annual Convention of the California State Firemen's Association will be held at Fullerton, Orange County, on August 7th, 8th and 9th, 1929, and all firemen of the State are invited to attend. An extensive program has been arranged and an enjoyable time will be had by all attending.

The California State Firemen's Association was organized in 1922, and has grown steadily in membership until now it has the largest membership of any firemen's organization in the Pacific States.

The objects of the Association are: To bring the firemen of the State into closer contact with

each other and to promote friendship between the firemen of the different sections of the State; to promote legislation for the benefit of its members and to assist in the establishment of a higher grade of fire-fighting equipment in the various communities of the State.

The present officers of the Association are: Captain W. A. Myers, Los Angeles, President; Lieut. R. E. Thompson, Stockton, First Vice-President; W. C. Fox, Santa Ana, Second Vice-President; Chief Thos. S. Ward, Red Bluff, Third Vice-President; A. Olcovich, Redlands, Recording Secretary; and Battalion Chief H. E. Strasser, San Diego, Secretary-Treasurer.

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# Carbon Dioxide Systems Protect Electrical Units

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As the units in modern power plants become larger, the necessity for protecting them from damage commands increasing attention of the engineer. Elaborate systems of relays and switches serve to preserve the continuity of service on the lines from a power plant. Electrical protection on all kinds of equipment is provided. But that most ancient bugaboo of the human race, fire, stands ready to do its disastrous work at many places in a power plant.

One might ask what there is in a modern fire-proof power plant which can burn, outside of the coal or oil under the boilers. The answer is, the insulation on all conductors, or at least that part which contains carbon and hydrogen compounds, and the oil in the large transformers and switches. These combustibles are in proximity with the current-carrying copper, which is the source of heat sufficient to cause fires at times of short-circuits or continued overloads.

The methods of extinguishing a fire in electrical equipment vary considerably. Water is the best-known medium for quickly putting out an ordinary fire and reducing the temperature of the combustibles. But water as a remedy for fire in electrical machines is almost as bad as the disease, as the equipment must be thoroughly dried out before it is again put in service. Carbontetrachloride has been suggested to replace water, and while it evaporates quickly and leaves the machine dry, it is an excellent solvent and the insulating compounds may be hopelessly damaged in this way. The introduction of an inert gas to smother the flame is probably the ideal method. Steam may be regarded as such a medium, but it is potentially liquid water and has all the objections of water. Perhaps the cheapest, most harmless, and still effective gas that may be used is carbon-dioxide.

United States laws provide for steam piping for smothering fires in cargo holds of vessels. To avoid the consequent damage to cargo when steam is thus used, many steamships have installed a carbon-dioxide fire-extinguishing system for primary use with the steam still available in an emergency and to comply with the law. The great volume of a ship's hold requires a large number of tanks of carbon dioxide, and this has partly retarded its general adoption. Since the volume of a compartment in a power plant may be made relatively small where fires are likely to occur, it becomes economically practicable to in-

stall carbon dioxide tanks and piping to these small areas for the smothering of fire.

In principle the system consists of a battery of tanks of compressed carbon-dioxide, connected by pipes to compartments and housing of electrical equipment in which fire may occur. In use the main valves at the tanks are opened, releasing the inert gas to the pipe lines. The proper valve in the pipe lines is then opened to admit the carbon-dioxide to that compartment where it is needed.

Under normal conditions there is no pressure in the pipe lines. The apparatus under pressure consists only of the tanks and their valves. When carbon dioxide as a gas under high pressure is slowly released through a small opening, as when an ordinary valve is partly opened, the gas cools upon expanding to atmospheric pressure. The cooling is sufficient to reduce part of the released gas to the solid form. If the gas is released rapidly from a tank, this freezing does not occur.

The piping to the desired points in the power plant is usually about one-and-one-half inch double-extra-heavy iron. In all cases the secondary valve is placed outside of the room containing the fire hazard in order that a man, upon discovering fire in the room where he may be, first gets out to a safe point himself and then turns on the carbon dioxide. Near each secondary valve is a break-glass station which electrically releases the main valves at the tanks when the glass is broken, in a manner similar to a fire-alarm box.

The end of the pipe is provided with two nozzles, usually monel metal, which are simply two pipe caps with a hole about three-eighths inch in diameter in the top. These nozzles are pointed in a horizontal direction and at various heights above the floor. Carbon dioxide is heavier than air, and the nozzles are preferably located a foot or two above the floor in order that the gas may flood the room, forcing the air out of an opening near the top. This opening is provided with an electric fan which is turned on after the fire is out and serves to remove smoke and the carbon dioxide from the compartment so that it may be entered for inspection. These compartments are not necessarily airtight. An ordinary door closes tightly enough to prevent excessive leakage of carbon dioxide. It is not necessary that the atmosphere consist of 100 per cent carbon dioxide to smother a fire. Experiments show that a proportion of only 25 per cent carbon dioxide in air is sufficient to put out a fire at once.

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# Danger of Static Electricity and Gasoline

Recent fires in garages, caused by frictional electricity during the handling of gasoline, have prompted exhaustive research to ascertain the true cause, and to devise a practical remedy therefor. Frictional or static electricity is more liable to be generated when the atmosphere is clear and dry than when it is moist. It is generated by the rubbing together of substances that in themselves are non-conductors of electricity. such as dry wood, rubber or gasoline; or it may be generated by friction between a non-conductor and a conductor, such as gasoline and a metal pipe, although in the latter the intensity is much diminished. In the drawing of gasoline from a pump into a metal can, no can should be used that has a wooden bail or handle in such a manner that the wood will intervene between the metal of the can and that of the pump on which it is hung. In filling the tank of a motor vehicle with gasoline from a metal can, care should be taken that good metallic connection exists, not only between the tank and other metallic parts of the vehicle, but between the funnel and the tank as well. The pouring can should have a piece of copper chain soldered to

the nozzle, the other end to rest in metallic connection with the tank or the funnel during filling. Motor vehicles that are filled by means of a hose direct from a storage tank or a portable tank should have hose with a continuous metallic lining which is in good metallic connection with the pump at one end and the shut-off nozzle at the other end, or with bare copper wire inside of the hose, with like connections at both ends. Shut-off nozzles at the end of hose lines should be fitted with copper chain to rest on the car tank in metallic connection during filling, or with a metal clamp serving the same purpose. The passage of the gasoline through a chamois skin strainer has been found to generate electricity which is collected in the metal parts of the funnel in dangerous intensity, and the substitution of a funnel with a strainer of 80 or 90-mesh wire which will exclude water is recommended. Safety lies in maintaining good metallic connection between the storage tank and the tank of the motor vehicle during the process of filling, so that all electricity generated may readily pass off to the ground as fast as generated.

---

## Flame Proofing

The conversion of inflammable materials into non-inflammable materials is engrossing the attention of many expert minds. And in using the word "materials" we include every article that is subject to consumption by fire. In fire-proofing fabrics it is the intention not only to prevent their burning, but to make impossible the spreading of the flames when they come in contact with the material at any point. In describing the process by which materials are made non-inflammable, P. W. Litchfield, of the Goodyear Tire and Rubber Company, says that the first step is the impregnation of the fabric and coating of the same with a non-inflammable mineral constituent which must first be fused or mechanically broken away before the fiber can burn. Then the presence of some salt, which in addition to the above action, will give off some gas such as carbon dioxide that, displacing the oxygen will prevent further propaga-

tion of the flame. There are three or more ways of carrying out this impregnation, one being the simple impregnation of the fiber with the mineral constituent as such; or, second, the use of such substances as glue, starch, dextrin, etc., as an adhesive for retaining the mineral constituent on the fiber, by first treating with a solution of such compound as soluble phosphate, and then immersing in a bath of alum, whereby the insoluble aluminum phosphate is formed in the fabric. Coming to the fire-proofing of balloon fabric, it is more difficult because of the usual presence of rubber which gives a new factor to the proposition. Here, perhaps, the presence, in the coating of compounds which liberate non-inflammable gases is more suitable than heavy loading of the fabric with mineral constituents which would increase the weight of the fabric and therefore be out of the question.

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# What Constitutes a Fire Hazard?

Broadly speaking, there are six important considerations which enter into the "hazard" in fire insurance, and likewise in the science of fire prevention and protection, viz:

## I. Exposure to Fire From Without

The exposure depends upon the width of streets or courts, the space between the new buildings and the neighboring buildings, and the nature of such neighboring buildings.

This hazard may be reduced, however, if the building is planned without openings facing the danger, or if wired glass windows, shutters, doors and skylights facing such exposure furnish standard protection. Outside sprinklers and fire hydrants can also be provided to reduce the danger.

## II. Construction of the Building

The hazard here is affected by the materials and workmanship entering into the construction, their thickness and strength.

An approved building code is generally utilized by the underwriters in judging the adequacy of wall thicknesses and the strength of materials.

Structural steel members are required to be thoroughly covered with fire resistive material; as terra cotta, brick, concrete or other approved material of adequate thickness. The material and workmanship should also be such that in case of fire, a powerful hose stream will not destroy the protection and expose the steel to flame.

The National Fire Protection Association at its annual convention in May, 1913, adopted regulations for a "Standard Fire Resistive Building of the Highest Type." This standard is for a building that would resist a temperature of 2,000 degs. Fahrenheit for four hours without material injury to its structural parts. Although impractical to erect all buildings as prescribed by this document, it is, nevertheless, an ideal that can be approached in any building at least in part. A suggested building ordinance especially intended for small towns and villages was also adopted in 1913 and treats especially of protection for "non-fire-proof" buildings.

## III. Plan of the Building

The hazard here includes question of height, area, the location of fire stops, facilities for the escape of the occupants and facilities for access for firemen.

The height of a building seriously affects its insurance, because, beyond a certain height the fire department cannot be depended upon, for the present at least, for effective work.

It is evident also that the larger the area the

greater the danger of the fire getting beyond control. When the area of any floor exceeds 5,000 square feet the insurance cost is generally higher. Fire stops are provided to decrease the area in large buildings.

Fire stops are either brick or concrete "fire" walls, no less than 12 inches thick, to prevent the fire spreading in a horizontal direction.

To prevent the fire spreading in a vertical direction through openings between stories, such as staircases, shafts, elevators, vents, ducts, etc., such openings are shut off by fire stops. These should be at least the same resistive quality as the floor construction dividing the stories.

For the purpose of allowing communication between the floors in a vertical direction, doors are provided which should be standard.

Of other elements included in plan and construction are the electric wiring and fittings, protection against lightning, whether the building be fire resistive or mill construction and windows of wired glass with metal frames. Special standards have also been adopted for the construction of railway car houses and for gravity tanks.

## IV. Fire Extinguishing Equipment

The hazard here is affected by the character of the protective apparatus, either stationary or movable, such as sprinklers, standpipes, pumps, valves, water supply, hand extinguishers, watchman's clock, fire drills, fire alarms, hose, etc., all designed to extinguish fire in its incipient stage.

## V. Nature of the Occupancy

The consideration of this hazard includes these points: Whether the merchandise and temporary fixtures are combustible or not, whether explosives or highly inflammable materials are stored, whether there are few or many employees, the nature of the work being done, whether or not the place is kept clean, whether or not the fire extinguisher apparatus is kept in order, and whether or not the special mechanism or apparatus being used is standard and properly taken care of. Gas machines and engines, incubators and brooders, kerosene oil pressure systems, oxy-acetylene heating and welding apparatus, waste cans and ash cans, films, oil storage and gasoline stoves for cooking, are all, if improperly installed, hazards of this nature.

The danger of fire due to carelessness or viciousness on the part of the owner is commonly known among underwriters as the moral hazard. It is quite distinct from the physical hazard, but a careful investigation of the moral hazard is essential in insurance.

(Continued on Page 111)

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## WHAT CONSTITUTES A FIRE HAZARD? (Continued)

### VI. Public Fire Protection

This part of the hazard which depends on the efficiency of municipal departments—notably fire, water and building departments, has an important bearing on the fire loss and consequently the

cost of insurance. Architects, builders and property owners can exert an important influence in fire prevention by encouraging the enactment of adequate laws on these subjects and insisting on an efficient administration of such laws.

## GENERAL HAZARDS

### Care of Ashes

There is nothing wonderful about that to talk about. We still have with us the man who shovels his hot ashes into a wooden barrel. Metal barrels do not cost much, but they are scarce among homes and hardware dealers should stock up on them and advertise them and thus get rid of all the wooden barrels.

I don't know whether we will have any ash barrels very long by the way oil burners are coming into use.

Approved devices require a pump feed, so if anything happens the pump can be stopped. Of course the oil should be kept outside.

### Paints, Oils and Spontaneous Ignition

Of course the problem of spontaneous ignition arises in many factories. A garage fire where a pair of garage man's overalls started a fire, of course is rather surprising to some of us. They were only saturated with mineral oil, but there was other dirt maybe that helped. When trying to duplicate such a mineral oil fire in our chemical laboratories we cannot do it, but evidently oily rags and overalls should be taken care of if fires are to be avoided.

### Gasoline, Benzine and Alcohol

All are familiar with these hazards. Most of them, except alcohol, have a heavy vapor settling on the floor like so much water. Take the rubber mills, they are full of such vapors, but have very few fires because all those processes are kept out of basements and pits. There was a building on which a tire and rubber company wanted insurance, but the floor of the room was eighteen inches below the grade and naptha is bound to settle in such a low place. The insurer did not like the suggestion to correct the defect very well and said he would be glad to insure the building himself, and excluded that building when insuring the main plant. Before the year was out the building burned twice and a man was killed and others crippled for life. Then the owner wanted to know what to do. He was told to fill it up so the floor would not be below grade. That was nine years ago. He did it and insured it and has not had a loss since. Naptha fumes collect in basements and low places. Some people

go to a lot of expense to buy fans and ventilating stops and all vapors in the vent tubes settle back. They start up at one o'clock and you get a fire. If we can remember those fumes are like so much water we can drain them to a safe place. There is no use working against the laws of nature. People try to lift them out the roof. They will not go out the roof but will go out on the floor level like water.

### Chemicals

When it comes to chemicals we are getting into a technical subject. Chlorates are found in dye works. Where there are any chemical works in his territory, the fire chief and his lieutenants ought to get acquainted with the places where those drugs and chemicals are kept so they will not put water on them. The same is true of carbide in the acetylene generator plants.

### Dust

Dust hazards are bad, especially in grain elevators. You know the farmer has explosions in threshing machines. Almost any dust will burn and explode. A lot of these explosions, like that in the big grain elevator in Chicago, occur from a little fire starting a little puff of dust. This ignites and causes a series of other puffs and they progress until by and by the million dollar elevator is ruined. They build up from a little explosion to a lot of explosions, each explosion driving more dust in the air as it goes along.

There is a book published by the department of agriculture which is very enlightening on the dust explosion feature. Dust should be swept up and be cleaned up. In a factory it does not make much difference what the dust is, although some dusts are more explosive than others. Steel filings will burn just as well anything else if finely divided. Dust of any nature in any factory is dangerous. There are not many explosions in a cement mill although there are some.

There is only one cause of fire and that is, disorder, something out of place. Lightning is all right if running down the chimney on an approved lightning rod.

No matter what fire you have there is always something out of place. A fire is all right in a stove, it is all right in a fireplace, but when it gets out into the house it is out of place.

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# To Find the Diameter of a Nozzle Equal to Two or More Smaller Nozzles

Square the nozzle diameter of each of the smaller nozzles; that is, multiply each small nozzle diameter by itself. Then add these products together. Take the square root of the sum so found and you will have the diameter of nozzle equal in cross section area to the areas of the smaller nozzles. After this has been done, find which standard size nozzle which is nearest in diameter to the diameter calculated, and this standard size nozzle is the one which is approximately equivalent from a capacity standpoint to the sum of the small nozzles.

As a specific case we will find the diameter of a nozzle equal to a  $1\frac{1}{2}$ -inch and  $1\frac{1}{4}$ -inch nozzle combined.

Square the diameter of the  $1\frac{1}{2}$ -inch nozzle and we get 2.25.

Square the diameter of the  $1\frac{1}{4}$ -inch nozzle and we get 1.56.

Add these two products together and we have a sum of 3.81.

Take the square root of 3.81, which gives us 1.952. This latter figure is the actual diameter of a single nozzle having an area equal to the area of the  $1\frac{1}{2}$  and  $1\frac{1}{4}$ -inch nozzles combined.

Now find which standard size nozzle comes the nearest to the 1.952-inches in diameter.

A 2-inch nozzle has a diameter of 2 inches. A  $1\frac{7}{8}$ -inches or 1.875 inches.

The difference between a  $1\frac{7}{8}$ -inch nozzle and the 1.952 diameter is .077.

The difference between a 2-inch nozzle and the 1.952 nozzle is .048.

Thus from these two figures it will be seen that the nearest standard size nozzle to the calculated nozzle diameter is the 2-inch nozzle. Hence a  $1\frac{1}{2}$ -inch nozzle and a  $1\frac{1}{4}$ -inch nozzle combined is approximately equivalent to a 2-inch nozzle.

The same method is employed where nozzles of a like size are being combined into a single nozzle. In this case each nozzle diameter is squared and the sum of the squares added; the square root of this sum taken which gives the diameter of a nozzle having an area equal to the sum of the areas of the small nozzles.

Following this the nearest standard size nozzle to the diameter so calculated is determined, and this standard size nozzle is the one which is taken as the equivalent of the areas of the several small nozzles.

## Carbon Monoxide

Carbon monoxide is a deadly gas which results from incomplete combustion of the carbon in wood and other materials. This is one of the gases which come from the exhaust of an internal combustion engine and has proven fatal in so many cases. If a man absorbs enough of the gas he becomes unconscious, with locked jaws and rolling eyes and his blood takes on a sort of cherry color. Death may result at the time or a day or two later. A moderate dose will often cause nausea and sick headache and may result in a weak heart unless the gas is quickly removed from the blood.

The gas is odorless, tasteless and invisible and a trifle lighter than air. When pure it burns with a blue flame, as seen in a coal furnace but with oxygen or air in proper proportions it forms an explosive mixture. It is not easily detected and men are even overcome before they realize that anything is amiss or before they are able to reach

a place of safety. Nearly all cases of smoke suffocation are caused by the inhalation of this gas which is said to be responsible for more deaths than all other gases combined. Poorly ventilated rooms, basements or attics sometimes become filled with the gas during a fire. Men are often overcome on entering such rooms or attics, and in some cases the fire, on reaching such accumulations of gas, causes an explosion which is commonly known as "back draft."

Being lighter than air, ventilation should be provided at or near the roof or ceiling and additional ventilation at the floor level will permit a current or draft which will quickly clear away the gas. Thorough ventilation will help to keep the danger to a minimum and firemen should not be sent into any poorly ventilated smoke enclosure or basement unless equipped with a smoke mask specially made for carbon monoxide, or a self-contained oxygen helmet.

This gas is apt to be encountered at a fire in any enclosed or poorly ventilated place as it is produced by the fire itself.

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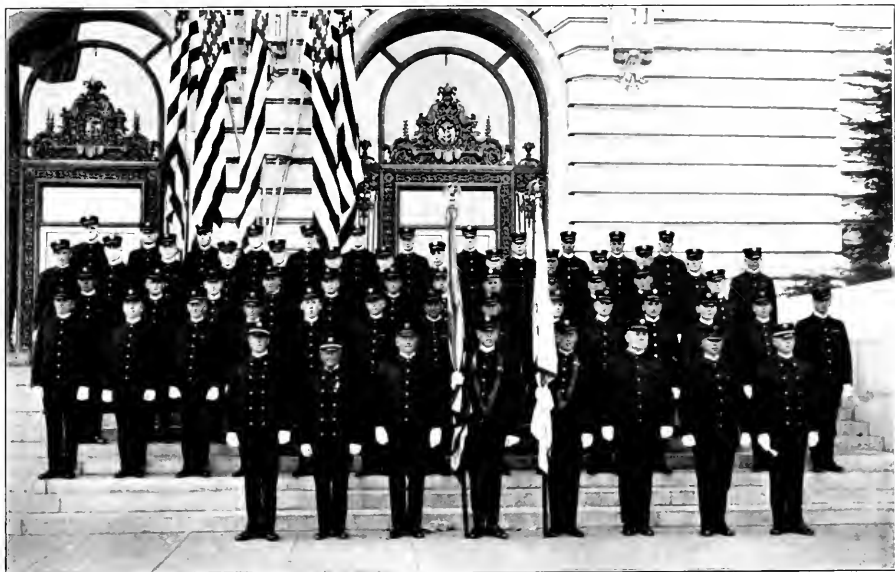
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By mill construction is meant a type of building originating in and much employed in building textile mills, especially in the New England section of the country. It is used principally because it is a better fire risk than joisted construction and as being particularly adapted to automatic sprinkler protection, and costs much less than fireproof construction. The principles of mill construction are as follows: First, it consists of making a fire stop of heavy planks between stories so that the spread of the fire may be retarded. Second, the timbers and flooring required to give necessary stability and strength are arranged so as to offer as smooth a surface and as few corners on which fire may feed as practicable; also doing away with all concealed spaces in walls and floors. This is accomplished by using very heavy floor timbers spaced eight to twelve feet apart and floors of three to four inch plank with single or double top boards. In a building of this character fire can be readily reached with water from either hose stream or sprinkler. Third, floors must be tight as well as heavy, so as to prevent fire, smoke or water from working through. This is one of the most important

features of a mill building, and one to which sufficient attention is seldom paid. Due to poorly seasoned plank or poor workmanship, openings are left around posts, at side walls, or elsewhere, and fire, smoke and water spread through these openings, destroying the efficiency of the floor.

## Flash Point of Oil

By flash point is meant that temperature at which an oil if heated generates vapor of density enough to ignite or flash without burning the oil itself. It is usually determined by placing the vessel containing the oil over a gas jet or burner, and immersing a thermometer in the oil. A burning match is brought directly over the oil at intervals of about fifteen seconds or so, as the oil is heating. A point is reached where on introducing the lighted match a flash is produced without the oil burning. This temperature is known as the flash point. The burning point of oil is from 20 to 30 per cent above the flash point. At this temperature the gas is generated with sufficient rapidity to continuously support combustion and to finally ignite the oil itself.

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THE PUBLISHERS of the Annual Fire Book are indebted to Chief Justice William H. Waste of the Supreme Court for the photograph from which the above picture of the old firehouse of Monumental Engine Companies Nos. 6 and 7 was made. The print was taken from a rare old negative which Chief Justice Waste has in his collection of old San Francisco pictures.

Monumental Engine Companies Nos. 6 and 7, of the old San Francisco Fire Department, were organized in June, 1850, and consisted of three engines on the plan of the Baltimore Fire Department, as an independent association. As the San Francisco City Council could not recognize independent companies, they had to exist without any city funds for a time, when they joined the general organization as three companies, receiving the numbers 6, 7, and 8 in the San Francisco Fire Department.

The Monumental firehouse pictured above was located in Brenham Place, and was surmounted with a bell which had an interesting history. It had previously hung on "Fort Gunnybags," and was rung as a signal for the assembling of the famous Vigilance Committee of the early days. It tolled the death knell for four men who were hanged after trial and conviction by that committee. It is said to have been the first bell used for public purposes ever raised in San Francisco. An earlier chronicler of the times says it "weighs only one hundred and eighty pounds, and cost one dollar per pound."

In 1858, the bell was, for some reason, sold to the congregation of a Petaluma Church, and for many years hung in the belfry of a church in that city. The San Francisco Chamber of Commerce was instrumental in having the bell restored to this city, and it was recently installed in the Merchants Exchange Building.

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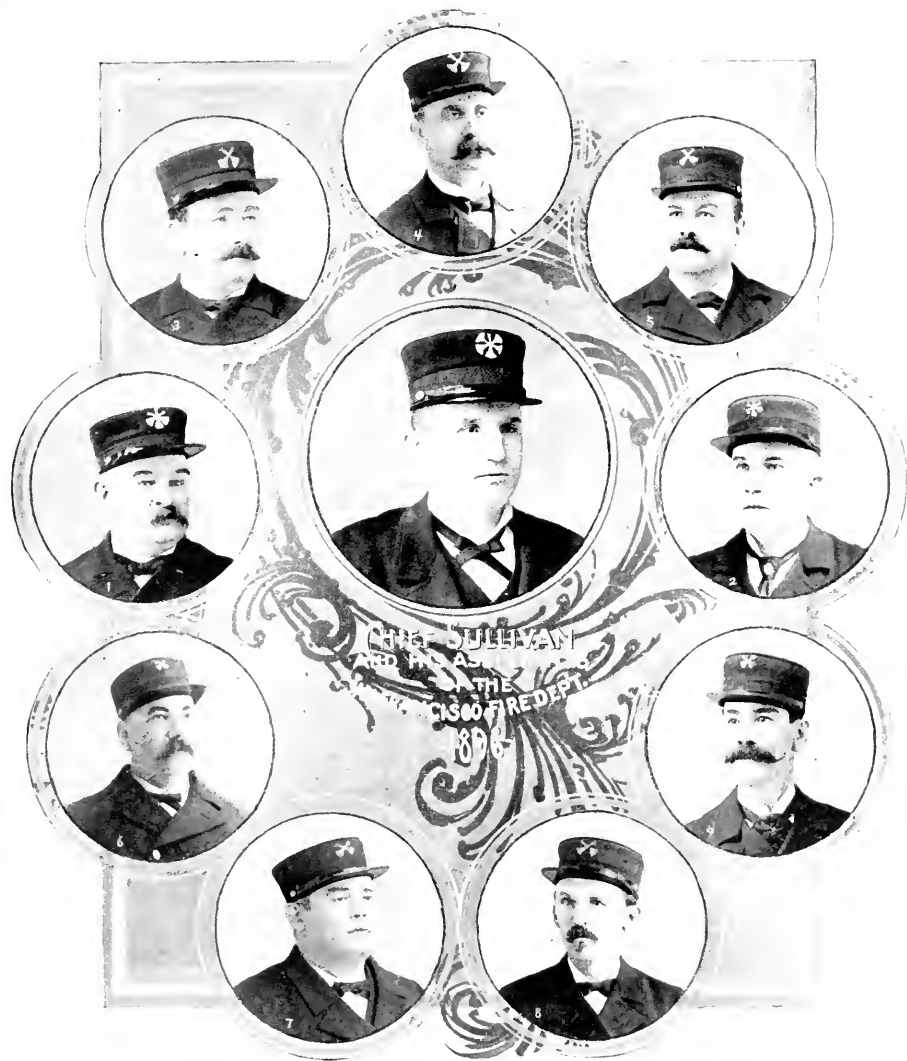
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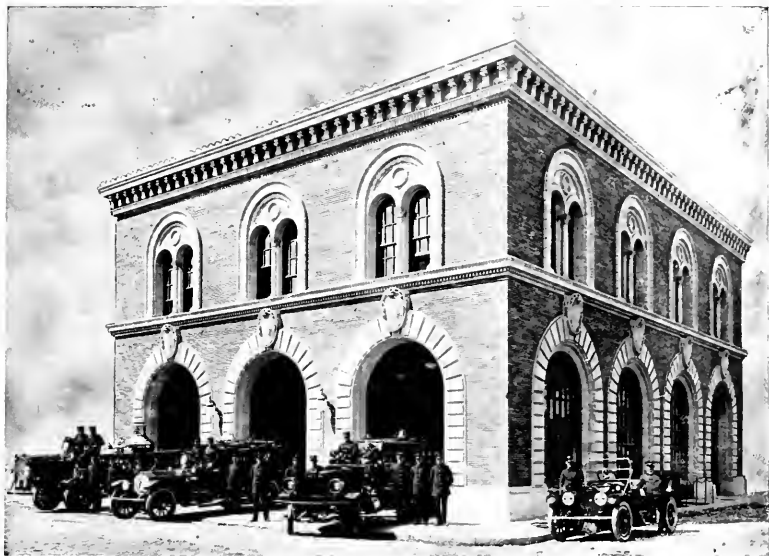
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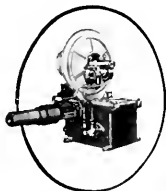
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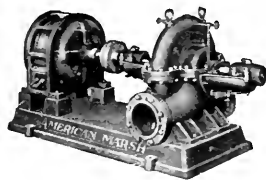
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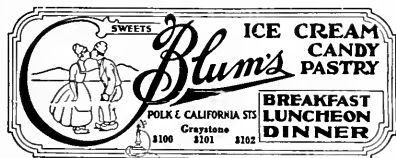
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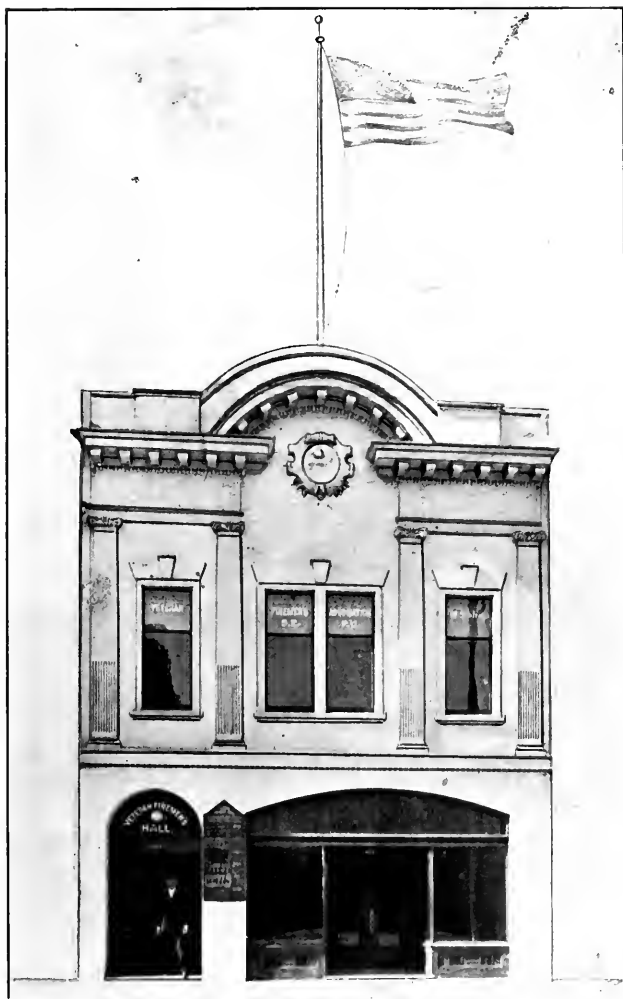
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# Contents

Veteran Firemen's Association of San Francisco.....	23	The Department of Electricity.....	89
Uniform Rank Veteran Firemen's Association.....	31	Card of Thanks.....	91
A Fireman.....	33	Eligible List for Promotion.....	93
Two Powerful Flood Lighting Units.....	41	Questions and Answers.....	97
The Value of a Fire College to a Fire Department..	43	Cal. State Firemen's Association.....	101
Radio and Its Use for Fire Prevention Work.....	45	Carbon Dioxide Systems Protect Electrical Units.....	103
The Hazards in the Use of Pyroxylin Lacquers.....	49	Danger of Static Electricity and Gasoline.....	105
New Laws.....	63	Flame Proofing .....	105
Ten Commandments of the Forest.....	67	What Constitutes a Fire Hazard.....	109
Entering Burning Buildings.....	67	General Hazards.....	111
Questions .....	71	To Find Diameter of a Nozzle.....	115
Uses of Carbon Tetrachloride.....	79	Carbon Monoxide.....	115
Fire Prevention and Public Safety.....	81	Mill Construction.....	121
Fire Extinguishment Methods.....	83	Flash Point of Oil.....	121
In Memoriam.....	87	Roster of San Francisco Fire Department.....	171

# Index to Advertisers

## A

Aaron, O. ....	176
Acme Bottle Supply Co. ....	128
Acme Hotel.....	129
Acme Misfit Parlors.....	120
Acme Ice Cream.....	58
Adam Arras Co. ....	129
Aetna Insurance Co. ....	20
Agnar, Paul.....	60
Airflex Mattress Co. ....	118
Air Line Transfer Co. ....	114
Ajax Foundry Co. ....	100
Allan, James & Sons.....	130
Allan, Candy Co. ....	121
Alberton Realty Co. ....	153
Alcazar and President Theatres.....	54
Alomite Lubricator Co. ....	38
Alexander, Ray.....	141
Alhambra Stucco Co. ....	170
Alhambra Theatre.....	110
Allen & Co. ....	93
Allen, C. W. ....	145
Allied Box & Excelsior Co. ....	148
Alta Roofing Co. ....	110
American Ambulance Co. ....	54
American Art Metal Works.....	142
American Baking Co. ....	147
American Concrete Co. ....	104
American Floor Surfacing Machine Co. ....	180
American Fannon Co. ....	11
American Laundry Machine Co. ....	94
American Rolling Mill Co. ....	18

American Salvage & Junk Co. ....	182
Ames, W. R. ....	80
Anchor Garage.....	168
Anderson & Rowe.....	122
Anderson, B. L. ....	144
Anderson Tire Co. ....	84
Andrews-Williams Biscuit Co. ....	129
Anzelo's Restaurant.....	170
Arps, R. G. ....	144
Arrow Garage Co. ....	112
Aristo Painting Co. ....	94
Art Iron Works.....	82
Art's Smoke Shop.....	62
Ash, J. L. & Co. ....	121
Atchinson, Dr. Wilbur H. ....	30
Atwood & Inzles.....	182
Autocall.....	120
Auto Body and Top Works.....	140
Auto Electric Supply Co. ....	150
Auto Fender & Radiator Works.....	98
Automotive Service.....	66
Automobile Armature Exchange.....	128

## B

Baron & Brayton.....	58
Baker, C. H. ....	125
Balboa Mill and Lumber Co. ....	178
Baldwin Hotel.....	160
Ba-ford, H. R. Co. ....	188
Balfour Building.....	101
Bank Garage.....	180
Banks Wrecking Co. ....	180

Barbe, J. & Co. ....	141
Barney's Tire Service.....	76
Barrel House, The.....	157
Barren, Jack.....	159
Barrett, Frank M. ....	148
Barr's Garage.....	176
Barsotti, M. & Co. ....	171
Barth, J. & Co. ....	60
Bateman, Wm. ....	111
Bauer Cooperage Co. ....	175
Bauer Mfg. Co. ....	144
Baxter, J. H. & Co. ....	56
Bay City Box Co. ....	111
Bay City Garage.....	146
Bay City Grill.....	98
Bay City Iron Works.....	82
Bay City Market.....	168
Baylaci, F. French Laundry.....	114
Bay Restaurant.....	94
Bay View Theater.....	136
Bea Garage.....	158
Bekins Van and Storage Co. ....	156
Belcher Street Garage.....	159
Belli, M. & Co. ....	172
Benedetti, Phil. ....	152
Bender Shoe Co. ....	172
Berser Mfg. Co. ....	184
Bertolone, G. ....	166
Bertrand Seed Co. ....	97
Bernheim, Jules H. Co. ....	178
Bernstein's Fish Grotto.....	126
Beverly Coat Hanger Co. ....	174
Bianchi's Machine Shop.....	154

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# Contents

Veteran Firemen's Association of San Francisco.....	23	The Department of Electricity.....	89
Uniform Rank Veteran Firemen's Association.....	31	Card of Thanks.....	91
A Fireman.....	33	Eligible List for Promotion.....	93
Two Powerful Flood Lighting Units.....	41	Questions and Answers.....	97
The Value of a Fire College to a Fire Department..	43	Cal. State Firemen's Association.....	101
Radio and Its Use for Fire Prevention Work.....	45	Carbon Dioxide Systems Protect Electrical Units.....	103
The Hazards in the Use of Pyroxylin Lacquers.....	49	Danger of Static Electricity and Gasoline.....	105
New Laws.....	65	Flame Proofing .....	105
Ten Commandments of the Forest.....	67	What Constitutes a Fire Hazard.....	109
Entering Burning Buildings.....	67	General Hazards.....	111
Questions .....	71	To Find Diameter of a Nozzle.....	115
Uses of Carbon Tetrachloride.....	79	Carbon Monoxide.....	115
Fire Prevention and Public Safety.....	81	Mill Construction.....	121
Fire Extinguishment Methods.....	85	Flash Point of Oil.....	121
In Memoriam.....	87	Roster of San Francisco Fire Department.....	171

# Index to Advertisers

## A

Aaron, O. ....	178	American Salvage & Junk Co. ....	182
Aeae Bottle Supply Co. ....	138	Ames, W. R. ....	80
Aeae Hotel.....	129	Anchor Garage.....	168
Aeae Misfit Parlors.....	120	Anderson & Rowe.....	123
Aeae Ice Cream.....	53	Anderson, B. L.....	144
Aetna Insurance Co.....	129	Anderson Tire Co. ....	84
Aezmar, Paul.....	60	Andrews-Williams Biscuit Co. ....	129
Airflex Mattress Co. ....	118	Anco's Restaurant .....	144
Air Line Transfer Co.....	114	Arps, R. G.....	144
Ajax Foundry Co.....	100	Arrow Garage Co.....	112
Allan, James & Sons.....	130	Aristo Painting Co. ....	51
Alberta Candy Co.....	121	Art Iron Works .....	82
Alberton Realty Co.....	151	Art's Smoke Shop .....	62
Alexcar and President Theatres.....	51	Ash, J. L. & Co.....	121
Alemite Lubricator Co.....	38	Atchinson, Dr. Wilbur H. ....	30
Alexander, Ray.....	141	Atwood & Inglis .....	182
Alhambra Stucco Co.....	179	Autocall .....	129
Alhambra Theatre.....	110	Auto Body and Top Works .....	140
Allen & Co.....	93	Auto Electric Supply Co. ....	150
Allen, C. W.....	143	Auto Fender & Radiator Works .....	98
Allied Box & Excelsior Co.....	148	Automotive Service .....	66
Alta Roofing Co.....	110	Automobile Armature Exchange .....	125
American Ambulance Co.....	54		
American Art Metal Works.....	142		
American Baking Co.....	147		
American Concrete Co.....	104		
American Floor Surfacing Machine Co.....	189		
American Fanon Co.....	31		
American Laundry Machine Co.....	91		
American Rolling Mill Co.....	48		

## B

Bacon & Brayton .....	58	Barbe, J. & Co. ....	141
Baker, C. H. ....	125	Barney's Tire Service .....	76
Balboa Mill and Lumber Co. ....	178	Barrel House, The .....	157
Baldwin Hotel .....	160	Barren, Jack .....	159
Basford, H. R. Co. ....	186	Barrett, Frank M. ....	148
Balfour Building .....	188	Barr's Garage .....	176
Bank Garage .....	101	Barsotti, M. & Co. ....	171
Banks Wrecking Co. ....	180	Barth, J. & Co. ....	60
		Bateman, Wm. ....	114
		Bauer Cooperage Co. ....	178
		Bauer Mfg. Co. ....	141
		Baxter, J. H. & Co. ....	56
		Bay City Box Co. ....	111
		Bay City Garage .....	148
		Bay City Grill .....	68
		Bay City Iron Works .....	82
		Bay City Market .....	168
		Baylawn, F. French Laundry .....	114
		Bay Restaurant .....	94
		Bay View Theater .....	136
		Bee Garage .....	158
		Bekins Van and Storage Co. ....	136
		Belcher Street Garage .....	156
		Belli, M. & Co. ....	172
		Benedetti, Phil .....	152
		Bender Shoe Co. ....	172
		Berger Mfg. Co. ....	184
		Bertolone, G .....	96
		Bertrand Seed Co. ....	162
		Bernheim, Jules H. Co. ....	178
		Bernstein's Fish Grotto .....	178
		Beverly Coat Hanger Co. ....	177
		Blanchi's Machine Shop .....	154

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LOS ANGELES: 1317 Willow, TR inity 5714

PORTLAND: 65 Allina Street, WA lnut 7650

# INDEX TO ADVERTISERS—(Continued)

Birch, W. I.	162	Bruhns, Henry R., & Co.	134	California Terazzo Marble Co.	159
Biscay, A.	168	Bruhn's Tire Covers	134	California Wooden Box Novelty Co.	172
Bishop, J. Co.	102	Brunton, Julius & Sons Co.	159	Callan & Muskrath	98
Blenio Process of Fireproofing	163	Buckley & Curtis	116	Cal-Us-Off	118
Blue Bird Cab Co., Inc.	120	Buck Bros. Welding Co.	116	Camel Auto Repair Works	72
Blue Ribbon French Bakery	112	Buick Motor Co.	4	Campbell, George	154
Blue Ribbon Garage	114	Building Supplies Co.	158	Candelio Bros.	166
Blum's Candy	163	Baker's Bird Store	150	Carlson's Home Made Pies	78
Board of Fire Underwriters of the Pacific	20	Bullard, E. D. Co.	147	Carlson, E. E. Upholstering Co.	79
Bodkin, Dr. Thos. P.	146	Bullock & Jones Co.	169	Carmichael's U-Drive Autos, Inc.	156
Boegershausen Bros.	110	Buon Gusto Sausage Factory	164	Carroll Bros.	185
Boggiano, Ch.	159	Burridge, B. W. Co.	156	Carroll, Paul, T.	153
Bohemian Garages	84	Burton, Portland & Co.	117	Cartman Tire Co.	179
Bollinger Automotive Works	98	Butcher, L. H., Co.	136	Casentini, John & Co.	156
Borck, L. J.	160	Butler, T. I. Co.	174	Cassidy's Grill	167
Bosc Automotive Service	162	Butler-Veitch	Inside Front Cover	Cassidy & Gratta	168
Boston Lunch	66	Button, A. P.	118	Castro Theatre	159
Boudin Bakery	128	Byington Electric Co.	156	Caswell's Coffee	161
Boussum, Photographer	165			Cavanaugh, Jos. G.	174
Bowie Switch Co.	158			Cavelier, Wm. & Co.	52
Bowman Plumbing Supply Co.	152			Celle, G. B. Co.	104
Bradford, Kimball & Co.	54			Central Auto Laundry	82
Brake Shop of San Francisco	88			Central Sterilizing Plant	126
Branchini's Grill	82			Century Dyers and Cleaners	157
Brass and Bronze Lighting Fixture Co.	150			Century Furniture Co.	132
Braun, Clarence T.	154			Cereal Products Refinery Corp.	110
Braun, F. H. & Co.	146			Chamberlain Metal Weather Strip Co.	148
Breuer, John, Co.	110			Chan & Chan Herb Co.	112
Prizzolani, S., Draying Co.	165			Charles Hotel	166
Poyer & Sons	146			Chenoweth, F. Byron	141
Broadway Tailoring Co.	182			Chesterfield Garage	165
Broadway Theatre	76			Chey, Benjamin	192
Broemme's Prescription Pharmacy	72			Chimes Music Store	52
Brostom, Oscar C.	180			Chutes at Beach	Inside Back Cover
Brousal, Mrs. E.	152			City Auto Wrecking & Supply Co.	112
Brown, C. M. & Son	175			City Construction Co.	136
Brown & Kennedy	158			City of Paris Cleaning Works	186
Brown & Miner Garage	88			City Rough Dry Laundry Co.	146

## C

Cable Market	42	California Steel Products Co.	134
Calins, Jay L.	117		
California Arms Co.	26		
California By-Products Co.	150		
California Cafe	168		
Cadillac Co-Operative Dairy Lunches	176		
California Concrete Co.	96		
California Corrugated Culvert Co.	159		
California Fuel Co.	131		
California Hall	117		
California Electric Supply Co.	164		
California Metal and Radiator Works	90		
California Mutual Bldg. & Loan Assn.	18		
California Photograph Co.	141		
California Screw Co.	96		

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# INDEX TO ADVERTISERS—(Continued)

Civic Center Garage.....	122
Claremont Auto Service .....	139
Clark Hotel .....	81
Class A Auto Paint Shop.....	128
Class A Garage .....	142
Classic Grill .....	173
Clay Street Garage .....	102
Clement, French Laundry.....	174
Clement Service Station .....	82
Cleveland Laundry .....	184
Cleri Marble and Mosaic Co. ....	135
Cloverdale Creamery .....	156
Clow Gastem Heating Co .....	14
Coast Side Transportation Co. ....	135
Coburn, Chas. ....	112
Coen Company .....	60
Cohn, M., & Co. ....	141
Coldwell, Cornwall & Banker .....	42
Cole Street Garage .....	182
Coliseum Garage & Machine Shop ..	170
Colonial Hotel .....	159
Columbia Steel Corporation .....	30
Columbus Bakery .....	133
Columbus Laundry .....	176
Colvin, C. A. ....	132
Combs Elevator Co. ....	106
Compagno & Son .....	42
Commercial Tire Co. ....	28
Commission Cafe .....	160
Community Tire Shop .....	160
Compton's, Gene .....	128
Conn, Edward E. ....	146
Conn, C. C., Ltd. ....	188
Coppa's Restaurant .....	156
Cottrell Brothers .....	188
Court Garage .....	140
Coutt's Super Service Station.....	135
Cox Cylinder Works .....	84
Creeley, Dr. T. E. ....	169
Crucian Garage .....	144
Crossett, A., Bro. & Co. ....	26
Crown Oil Co. ....	100
Crowley Launch & Tugboat Co. ....	141
Cudahy Packing Co. ....	164
Cunard Line .....	28
Cunco Bros. & Co. ....	146
Curran and Geary Theatres .....	113
Curran Floral Shop .....	73
Curtis Galleries .....	152
Curtis, H. R. Co. ....	48
Curtis, Ralph G. ....	170
Custom Feed Mills .....	134

## D

Dahl Oldsmobile Co .....	159
Dalma Garage .....	70
Daniels, Benj. F. ....	102
Dave's Service Station .....	88
Davis, F. C. Packing Co. ....	62
Davison, Lowell .....	127
Dealers Refrigerator Co. ....	115
Deasy, Con J. ....	122
Deaton, L. P., Helius Co. ....	89
Del Grande, A. ....	176
Del Monte Creamery .....	90
Del Predici, A., & Son .....	152
De Luca & Son .....	170
De Luxe Super Service Station .....	172
De Luxe Wrought Iron Works, Inc. ....	182
Demartini, L. Supply Co. ....	92
De Matta, Christian .....	157
Demuteli, L., & Co. ....	146
Depositi, L. ....	164
DeUrie, A. ....	133
Deutch, Sol., & Co. ....	158
Devinezzi .....	184
Devinezzi Bros. & Co. ....	162
Devoto, A. A. ....	172
Dickey Master Tile .....	92
Dick's Tavern .....	156
Diez, W. J. ....	162
Dischville Construction Co. ....	116
Doane Motor Truck Co. ....	162
Doherty Bros. ....	74
Donic, M. ....	157
Donohoe & Carroll .....	152

Doris Garage .....	186
Dorsey & Dickenson .....	119
Dowd's Bakery .....	82
Dowd-Seid Electric Co. ....	172
Dowd-Welch .....	174
Downtown Parking Stations .....	84
Doyle Sheet Metal Works .....	151
Dragon, H. D., Co. ....	144
Dreyfuss Press .....	129
Duddy & Kibbee Printing Co. ....	160
Duffin Service .....	154
Duncan, F. V. ....	149
Duncan, John M., Co. ....	176
Durkee Thomas Products Co. ....	164

## E

Engelson & Co. ....	158
Eastern Bakery .....	156
Eatonian Kodak Store .....	84
Eaton & Smith .....	66
Eclipse Lime & Cement Co. ....	134
Edmonds Bros. ....	130
Egan, Frank J. ....	74
Egyptian Lacquers .....	64
Electric Storage Battery Co. ....	68
El Capitan Theater .....	92
El Patio Brake & Wheel Aligning ..	122
Elk Service Station .....	142
Empire Planning Mill .....	148
Enderlin, A. N. ....	176
English's Service Station .....	136
Enterprise Boats .....	88
Enterprise Boat Works .....	163
Enterprise Foundry Co. ....	120
Epler's Bakery .....	121
Ernst & Ernst .....	70
Estad's Spanish Kitchen .....	106
Eureka Boiler Works Co. ....	76
Eureka Stove Co. ....	68
Excelsior Bakery .....	162

## F

Fada Radio .....	113
Fairmont Hotel Garage .....	166
Fair Manufacturing Co. ....	107
Farris, C. P. ....	124
Fat Boy Barbecue .....	198
F. & L. Garage .....	56
Federated Metals Corporation .....	138
Feldman & Eiler .....	185
Fell Street Garage .....	74
Ferran, Mme. Pilet & Co. ....	186
Ferry Sheet Metal Works .....	138
Fess System Co. ....	155
Fichtner & Simon .....	106
Filbert Garage .....	102
Fina, P. ....	158
Finn, John, Metal Works .....	100
Finnell & Co. ....	58
Fire Association of Philadelphia .....	76
Fireman's Fund Insurance Co. ....	12
Fire Protection Engineering Co. ....	24
Fire Protection Products Co. ....	151
Fior d' Italia Cafe .....	163
Fisher Finance Co. ....	141
Fitkin, A. E., & Co. ....	11
Flat Rate Auto Repair Shop .....	112
Florence Ravelli Co. ....	158
Flynn & Collins .....	169
Fly Trap Restaurant .....	122
Folsom Street Iron Works .....	68
Ford Auto Park Station .....	156
Foreman & Clark .....	46
Foster Lunches .....	129
F. P. S. ....	165
Fricke, Gustave .....	148
Frontier Studios .....	123
Fourth Street Tailoring Co. ....	137
Fontanella, Louis .....	98
Fox Theatre .....	116
Franklin Flick & Co. ....	26

Franklin Pacific Motor Co .....	46
Franzen & Parent .....	176
French Baking Co. ....	162
French, J. E. Co. ....	132
French Laundry and Cleaners .....	156
Front Street Service Station .....	153
Frye & Co. ....	184
Furlong, James .....	198

## G

Gallenkamp's .....	124
Gallagher, Wm. J. ....	110
Galli & Galli .....	42
Galtie, L. ....	86
Gardner Pacific Co. ....	42
Gartland Hotel .....	141
Gates Hotel Apartments .....	141
Gay, Mme. J. B. ....	168
Geary Bakeries .....	133
Geary Garage .....	144
Gehler, Gus. A. ....	186
Gehler Welding and Boiler Works ..	151
Gelber, L. ....	160
Gem Novelty Co. ....	142
General Petroleum Corporation .....	6
Geneva Nursery .....	141
George's Auto Repair Co. ....	168
George's Whist Club .....	68
Gerlach's .....	84
Gerhardt, Geo. T., Inc. ....	70
Gernetti, John. Co. ....	136
Gervick, Ben. C., Inc. ....	86
Gillette & Lemmon .....	132
Gillon, E. E. ....	158
Ginsberg Tile Co. ....	164
Giusti's Garage .....	139
Giuliani, A., & Bro. ....	178
Glaser Bros .....	184
Globe Electric Works .....	139
Godeau, Julius S. ....	34
Goeftert Bros. ....	176
Golden Eagle Soap Co. ....	40
Golden Gate Beverage Co. ....	112
Golden Gate Coal Co. ....	178
Golden Gate Draying Co. ....	144
Golden Gate Dying & Cleaning Works ..	142
Golden Gate Garage .....	174
Golden Gate Radiator Works .....	160
Golden Gate Recreation Bowling Academy	76
Golden Gate Steam Laundry .....	142
Golden Gate Undertaking Co. ....	159
Golden Eagle Coffee Co., Inc. ....	148
Golden Rule Co. ....	150
Golden State Macaroni Co. ....	190
Golden State Milk Products Co. ....	72
Golden West Calf Co. ....	142
Golden West Garage .....	162
Goldstein & Co. ....	92
Good Bros. Dairy Co. ....	36
Goodrich Automatic Oiling System .....	154
Goss, Wm. F. ....	158
Gough Alfred S. ....	182
Gough Furniture Co. ....	158
Goulding & Curran .....	152
Grace, Jos. M. ....	127
Grace Lumber Co. ....	135
Granada Grill .....	145
Grand Garage .....	154
Grand Hotel .....	132
Grandma Cakes and Cookies .....	145
Graney's Billiard Parlor .....	92
Granfield, Farrar & Carlin .....	146
Gray Line, Inc. The .....	178
Graystone Laundry .....	168
Great Northern Garage .....	170
Grease Spot, The .....	162
Great Nature Herb Co .....	82
Greenberg, M. Sons .....	90
Grimes & Swift .....	26
Grimley, Frank J. ....	165
Gross, Felix, Co. ....	161
Gross, Felix, Coal Co. ....	161
Guerin, J. S., & Co. ....	164
Gullmes, J. Victor .....	116
Garley-Lord Tire Co .....	166

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# INDEX TO ADVERTISERS—(Continued)

## H

Haas Wood and Ivory Works	161
Hahn, Otto W. Co.	88
Haight Street Service Station	88
Haight Theater	156
Hale Bros. in the Mission	26
Hall, Wm.	152
Halle, R. H. Co.	102
Halsted & Co.	2
Hammer's Dress Shop	86
Hamilton's, Inc.	180
Hamilton Construction Co.	141
Hammer's Buick Repair Shop	154
Hamill, Thomas	156
Hanni & Gierd	124
Hansen & Downing	166
Harasin, Gab.	108
Harband, N., Trunk Co.	178
Harder, F. H., Mfg. Co.	133
Harder's Planing Mill	90
Harischfesser Corporation	117
Harris & Spear	183
Harris's Auto Parts	112
Harry Howard	34
Hastings	10
Hauser Window Co.	134
Hayes Valley Bakery	147
Hayes Park Laundry	80
Heald's College	32
Heidenreich, Wm.	86
Henn, Dr. Gustave B.	162
Henry's Tire Shop	136
Herald Garage	156
Hercules Powder Co.	122
Herring & Nutting	172
Hertz Drive-Your-Self Station	12

Herzig Built Homes	114
Higgins & Kraus	180
Highway Garage	166
Hillard, C. J., Co.	106
Hillman, Lloyd K.	26
Hirsch Brothers Co.	96
Hittenberger, C. H. Co.	154
Hock & Hoffmeyer	184
Hollingberry, "Babe"	84
Holmes Express	78
Home and Diamond Laundries	60
Home Clothing Co.	40
Home Transfer and Moving Co.	150
Hopkins Spray Equipment Co.	141
Horst, E. Clemens, Co.	122
Hottel's Garage	162
Howard, Harry	34
Howe, V. C. & Co.	169
Hoves Lumber Co.	136
Holzmueller, C. J.	163
Hub Cleaners and Hatters	120
Hub Florists	160
Huff, Russell	114
Huges, T. N., Auto Park	84
Hume, G. W., Co.	122
Hutton, E. F., & Co.	58
Hjøl's Coffee and Lunch House	145

## I

Independent Dyeing and Cleaning Works	134
Independent Oil Co.	90
Indemnity Insurance Co.	24
International Radiator Co.	140
Inverness Garage	162
Iron and Steel Contracting Co., The	174

Irvine & Jachens	180
Irvine, J. J.	172

## J

J. & M. Radiator Co.	159
Jackson Garage	184
Jackson, G. B. & Son	90
Jack Johnson Roofing Co.	151
Jacoby, Henry	160
Jacopetti, E., & Sons	152
Jamieson, Walter	150
J. N. J. Firebrick Construction Co.	138
Joe's Auto Park	133
Joe's Ford and Chevrolet Wrecking Co.	142
Joe's Service Lunch	96
Johnstone's Garage Supply Co.	128
Johnson-Locke Mercantile Co.	174
Johnson Oil Burners	95
Johnson's Rip Sawing Cut-Off Machine	139
Johnson's Safety Saw Works	139
Jones Bros. Asbestos Supply Co.	121
Justice Garage	160

## K

Kaddas Grill	82
Kahn, Bert	153
Kane, A. J., Detective Agency	56
Kane, Chas. F. & Co.	164
Kapkin, G.	142
Kass' Dairy Lunch	146
Katz, Phil C.	124
Kay, F. W. Co.	184
Kelleher & Browne	48

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# INDEX TO ADVERTISERS—(Continued)

Kelly Brothers	150
Kelly's Garage	78
Kemmerle, Martin E.	156
Kemp, Edward H.	176
Kemp, Geo. C.	176
Kenny, D. I. & Sons	23
Kenney, Ed.	147
Kent Electric and Hardware Co.	164
Kern Garage	162
Kern, F. & Sons	160
Killeen, J.	166
Kingswell Bros.	138
Kirkpatrick, A. J.	126
Kleiber Auto Co.	70
Kloeres & Koch	126
Knuts, Wm.	142
Koffee Kup Restaurant	124
Koff Realty Co.	Inside Back Cover
Knege, P. V. & Co.	162
Krazen's Pt. Lobos Garage	162
Kreling's	147
Krenz, Oscar, Copper & Brass Works	180
Kroehler Mfg. Co.	90
Kruse, J. H.	165

## L

Lafayette French Laundry	163
La Forinsee, Delintessen	160
Lafrenz, F. W. & Co.	72
Lambert Co., Ltd.	66
Lambert Sales Corporation	163
Lando, the Blindman	116
Langdon, O. D.	166
Lankershim Hotel	72
Langdon's Auto Service	9
Larkin Specialty Mfg. Co.	170
Lattimore, A. E.	174
Lauchner Bros., Inc.	152
Leary, J. Scott	172
La Tourette, Emmett W.	70
Leavitt, J. W. & Co.	16
Leavitt, S. Cooperator Co.	184
Le Clair Power Drag Scrapers	164
Lemoze, Victor	142
Lenzfeld's Prescription Pharmacies	150
Leonard Lumber Co.	164
Lerer, Jon. & Sons	171
Leslie Salt	86
Levin, A. & J.	182
Levin's Auto Supply Co.	92
Levin, M., & Sons	171
Levin, R.	158
Levy, Mark J. Auction Co.	144
Lewin Drug Co.	117
Lewis, Bert R.	80
Lewis, Inc.	150
Liberty Bakery	138
Liberty Cleaning & Dye Works	124
Liberty Dairy Co.	128
Liberman Ro-cranets Co.	138
Lick Grill	164
Lincoln and Sutter Theatres	158
Linden Decorating Co.	163
Lindberg & Freese	166
Lipton's Tea	117
Linton, Harry	132
Lo-Fare Cabs	127
Lozan & Bryan	52
London & Lancashire Insurance Co.	28
Lorenz, F. A.	166
Los Angeles Steamship Co.	119
Louis' Fashion Restaurant	150
Loustau, Mme. L. & Co.	183
Loveland Engineers, The, Inc.	163
Lowe, Jack	166
Lowie, M. W.	74
Lucas, A. J.	184
Lucchetti's Restaurant	152
Luckenbach Steamship Co.	50
Lurline Garage	154
Lux U. S. Paint Spraying Equipment Co	124
Lybrand, Ross Bros. & Montgomery	111
Lyons, Wm.	176
Lynch, E. J. Electric Co.	178
Lynch & Sons	86

## M

MacNicholl & Co.	184
Mazgini Motor Car Co.	137
Magner Bros. Paint Co.	136
Maher, Dan P. Paint Co.	157
Mahoney, Bill	118
Majestic Ballroom	50
Mallott & Peterson	75
Mandarin Theater	117
Mangrum-Holbrook Co.	122
Manila Art Co.	184
Marchetti Motor Patent	121
Marconi Plastering Co.	120
Marina Garage	142
Mario, H. B., Panel Co.	150
Market and Dolores Service Station	162
Marron's Clover Creamery	76
Marsh Garage	58
Marshall-Newell Supply Co.	147
Martin-Semour Co.	138
Martin's Welding Service	150
Martinielli, Julius & Co.	80
Maskey's	179
Master Lubricants Co.	132
Matlock & Peasey	160
Matteucci & Vannucci Co., Inc.	142
M. B. M. Auto Laundry	154
McAllister Street Garage & Service Station	22
McAvoy, O'Hara & Co.	160
McCabe, D. C.	134
McCallum, J. H.	139
McCarthy, J. Justin, M. D.	127
McCormick's Cat and Dog Hospital	119
McCreery, Finnell & Co.	49
McDonnell & Co.	154
McKee, Sam & Co.	Back Cover
McLean, Walter S.	139
Meda Art Tile Co.	50
Meherin, Mark M., & Son	139
M. J. B. Service Station	127
Mendel & Bauer	160
Mentone Hotel	138
Merchant Garage	147
Merchants National Adjusting Assn.	108
Merello's Smoke Shop	170
Methodist Book Concern	169
Mervin Geo. S. Co.	174
Mexico City Cafe	140
Meyer Bros.	146
Meyer's Soda Water Co.	123
Michel & Pfeffer	136
Milk Dealers Assn. of San Francisco	129
Miller Fireproof Storage Co.	Back Cover
Miller, Gro. W.	186
Miller, Parke E.	169
Millikan, Chad, Sandwich Shoppe	163
Mint Auto Park	141
Miramar Garage and Machine Co.	151
Mission Concrete Co.	117
Mission Pharmacy Co.	123
Misrak's Auto Supply Co.	172
Mission Vulcanizing & Tire Co.	108
Moeller, Gus & Sons	152
Moffat, H. Co.	52
Mozan & Co.	116
Molinari, P. G. & Sons	182
Moller, Fred	157
Monson Bros.	117
Monteverde, Rolandelli & Parodi	184
Mon's Blue Ribbon Garage	114
Moore, C. C. & Co.	157
Moore, Jno. R. & Son	159
Moore & Madsen	166
Morgen Jewelry Co.	176
Mork, Peter	166
Morton, G. Y., Co.	183
Mosaic Tile Co.	157
Motor Arms Garage	137
Motor Inn Garage	83
Motor Parts Sales Co.	173
Motor Service Engineering Co.	68
Motor Shop, The	88
Mowat Corporation, The	159
Muraaky, W. T.	164

## N

National Electric Co.	160
Nature's Herb Co.	152
Neal Institute, The	74
Neely & Co.	94
Nelson, A.	127
Nelson, Jas. A.	126
Neptune Meter Co.	72
Neverstill Brake Service	172
Nevill Bros. Van and Storage, Inc.	30
New Balboa Service Station	162
New Century Beverage Co.	106
New Domestic French Laundry	108
New Fillmore Theatre	131
New Liguria Bakery	164
New Mission Market	164
New Mission Theatre	178
New Parisian Hair Cleaning	162
New Process Laundry Co.	174
New Shanghai Cafe	158
Nichols, Geo. V.	159
Nicholson, Harry M.	152
Nieri, A. Sauvage Mfg. Co.	142
Nierman & Lefkowitz	93
Nimmo, George	178
Ninth Street Auto Service Station	152
Noque French Laundry	166
Normandie Garage	127
North Beach Auto Hauling Co.	110
North Star Laundry Co.	164
Nugent-Covey Wagon Co.	152

## O

Oakdale Service Station	166
Oakley Lumber and Mill Co.	172
O'Brien's Service Station	178
Occidental Furniture Mfg. Co.	135
Ocean Shore Iron Works	169
Ocean View Bakery	169
Office Trolley Supply Co.	156
Oliver Supply Co.	142
Oliver, A.	136
Oliver French Bakery	136
O'Neill & Johnson	30
Optimo Clear	86
Original Health Food Store	84
Ostlund, Oscar H.	152
Ostrowski, Frank S.	76
Outen Bros.	

## P

Pacific Auxiliary Fire Alarm Co.	164
Pacific Bax Co.	8
Pacific Coast Automobile Assn.	138
Pacific Coast Glass Co.	136
Pacific Coast Products	46
Pacific Coast Steel Co.	102
Pacific Cooperator Co.	140
Pacific Daily Racing Form	154
Pacific Felt Co.	153
Pacific Tire Sales Co.	156
Pacific Gas Heating Co.	174
Pacific Mill and Cabinet Co.	154
Pacific Outfitting Co.	154
Pacific Pipe Co.	129
Pacific Pump and Supply Co.	160
Pacific States Construction Co.	96
Pase's New Garage	152
Paladini, A. Inc.	152
Pal's Cafe	150
Parana Mfg. & Commercial Co.	151
Paradise Hygiene and Cleaning Works	148
Paradise Restaurant	148
Pauli, R. P., & Co.	88
Park Inn	124
Parker, E. R. System	76
Parkhurst U-Drive Auto Rental Co.	182
Patterson & Roster Iron Works	82
Paul Elder & Co.	
Paulsen & Co.	
Pavilion Ice Bank	
Pearl Oyster House	

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# INDEX TO ADVERTISERS—(Continued)

Peerless Laundry	143
Peerless Ornamental Iron & Bronze Co.	121
Peirano, L. S.	178
Pelton Water Wheel Co.	94
Penino, A.	72
Pennington, G. W. Sons, Inc.	165
People's Laundry	156
Perkins, Dudley	140
Pertigera, Joe and Co.	174
Peters, Dr. William	141
Petry & Brandt	76
Petri Cigar Co.	104
Philbrick, E. D., Co.	78
Phillips Baking Co.	78
Phillips, Frank M., Co.	180
Phoenix Linen Supply Co.	129
Piconi, J. M.	157
Pine Garage	170
Piehl, Wm.	144
Pinkerton, James H. & Co.	156
Pioneer California Wood Novelty Works	185
Pioneer Soap Co.	133
Pittsburg Water Heater Co.	169
Podesta & Baldochi	130
Folk Street Auto Service Co.	124
Pompeii Macaroni Factory, Inc.	114
Poppy Bakery	186
Post Street Garage	151
Poscar's Food Products	121
Port Costa Brick Works	22
Portola Garage	147
Posch, Paul H.	112
Presco, Oscar & Sons	109
Price's Ye Quality Shoppe	140
Progressive Baking Co.	138
Progress Drug Co.	136
Progress Enameling Co.	172
Progress Garage	182

Progress Repair Shop	138
Progressive Tile and Mantel Co.	78
Purdy, Wm. O.	110
Purity Sausage Co.	182
Purpora, J. & Co.	146
Pyrene Manufacturing Co.	11

## Q

Quandt, A., & Sons	152
Quarg Music Co.	136
Quayle Electric Works	175
Quinn, John	140

## R

Ralph & Earl	182
Ranghiacci, Sam	152
Ranis, Jack	141
Rasori, A.	79
Rathjens, P. F., & Sons	122
Rathjen Bros.	148
Rattos Garage	170
Ratto Hardware Co.	159
Rauer's Law and Collection Co.	159
Raybestos Brake Lining - Inside Back Cover	61
Rayfield Automatic Oil Burner	116
Raytheon Manufacturing Co.	23
Ray, W. S., Manufacturing Co.	164
Reading Steel Casting	130
Rebizzo, M. & Co.	144
Red Cherry, The	150
Red Top Cabs	134
Rees Blowpipe Mfg. Co.	116
Regalia, Fred	184
Reilly, Robert M.	184

Reichardt, Otto H., Duck Farm	106
Reinhold, D. O.	176
Reine Co.	169
Reliable Loan Office	132
Reliance Trailer and Truck Co.	186
Reliable Painting Co.	160
Remedial Auto Loan Co.	176
Renon Baking Co.	172
Reo Motor Co. - Inside Front Cover	178
Republic Hotel and Cafe	36
Rhode, Jack	171
Rich, J. M. Co.	151
Richardson, Eri H.	167
Richardson, Ignatius A.	154
Rich Pie Shop, Inc.	153
Riddle Sheet Metal Works	168
Rincon Iron Works	154
Riznik, L., & Son	168
Roberts Mfg. Co.	96
Robertson Drayage Co.	191
Rodoni-Becker Co.	113
Rolph, Jas. Jr., Landis & Ellis	15
Roma Baking Co.	101
Roma Macaroni Co.	42
Romeo, A., Fish & Oyster Co.	137
Ross Bros.	136
Roosevelt Apparel Shop	182
Rose Hotel	173
Roseblum-Abraham Co.	165
Rosenberg, Meyer	121
Rossman Corporation of California	129
Roth's Fine Tailors	118
Rothchild Jewelry Co.	112
Rowe Vending Machine Co.	154
Royal Garage	158
Royal Ice Cream Co.	120
Royal Mill and Cabinet Co.	167

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# INDEX TO ADVERTISERS—(Continued)

Royal Tallow Soap Co.	34
Royal Showcase Co.	116
Royal Theatre	110
Rusco Brake Lining	32
Rossi & Co.	151
Russell Milk Service	169
Rud Heater Co.	120

## S

Sacramento Hor Co.	130
Sacred Heart College	62
Samarkand Ice Cream	102
Sandell, Al	185
Sandwich Shop	117
San Francisco Cleaning and Dyeing Works	135
San Francisco Engineering Co.	145
San Francisco Galvanizing Works	180
San Francisco Hog Co.	130
San Francisco International Fish Co.	163
San Francisco News Co.	172
San Francisco Plating Works	166
San Francisco Riding School	94
San Francisco Wheel Co.	103
Scatena-Galli Fruit Co.	78
Scavenger's Protective Assn.	146
Schafer, A.	146
Schomer, L. M.	64
Schrader's Ant Powders	143
Schuler, Sydney R.	156
Schulte, Geo.	133
Schulte, H. & Son	118
Schultz, Paul	172
Schwabacher-Frey	36
Sea Cliff Garage	186
Seaboard Garage	168
Security Storage and Van Co.	113
Segalas, Charles, Co.	100

Seipol Ornamental Iron Works	44
Seoulia Garage	142
Serpa's Shaving Parlor	141
Serveau, Emile	146
S. & M. Garage	146
Shannon-Commy Printing Co.	153
Shasta Hotel	96
Sherman Pharmacy	68
Shipman, J.	136
Sibley Grading and Teaming Co.	80
Sierist, P. R. Co.	109
Sierra Equipment Corporation	132
Silver, John	142
Silver Laundry	139
Simonds Machinery Co.	155
Simpson's	82
Simpson & Fisher	157
Sing Fat Co.	127
Sixth Street Garage	158
Skillicorn & Powers	151
Smith, C. W., Copper Works	126
Smith Electric Co.	160
Smith, Howard F. & Co.	14
Smith, John W.	116
Smith, Stanley W.	179
Snyder's Auto Metal Works	136
Snyder, Christopher Henry	135
Solaris, Fred, Grill	153
Sonoma Mission Creamery	150
South S. F. Tallow Works	137
Sperry Hutchinson Co.	127
Spiller & Rossi	176
Spivock & Spivock	37
Springfield Fire and Marine Ins. Co.	167
Standard Auto Repair Shop	152
Standard Concrete Construction Co.	164
Standard Garage	164
Standard Iron and Metal Yard	154
Staples & Pfeiffer	170
Star Dairy Lunch	170
Star Ornamental Iron Works	102

Starlight Furniture Co.	172
Starlight Laundry	171
Stute Garage	176
States Hof Brau	120
State Manufacturing Co.	180
St. Charles Market	156
St. Francis Garage	162
St. Francis Hospital	31
St. Mary's Park	128
Stauffer Chemical Co.	106
Steffens, August	94
Steinhauer's Bakery & Coffee Shop	108
Stiefater's	149
Steiger & Kerr Stove & Foundry Co.	143
Stempel's Quality Doughnut Shoppe	184
Stephenson & Nichols	62
Stephenson Construction Co.	111
Sterling Auto Top Co.	160
Sterling Hedding Shop	153
Sternberg, David	108
Stockton Fire Brick Co.	76
Stone Candy Co.	148
Stuart Oxygen Co.	148
Stubo, Harold M.	74
Sudden Lumber Co.	86
Suzarman, E.	104
Suhr, H. F.	154
Suhr & Wieboldt	122
Sullivan, Dr. J. & T.	114
Sullivan's Pet Shop	166
Sunden, Dick	49
Sunset Feather Co.	128
Sunset Iron Works	130
Super Auto Painting Co.	137
Superba Packing Co.	170
Superior Auto Repair	135
Superior Grinding & Motor Parts Co.	130
Superior Sausage Factory	35
Sutro, C.	92
Squires, Dr. M. O.	

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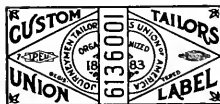


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# INDEX TO ADVERTISERS—(Continued)

## T

Taylor's Garage.....	182
T. & T. Electric Co. ....	135
Thieler, John H. ....	38
Thompson Bros. ....	179
Thompson's Drug Stores .....	159
Thorne Retinning Co. ....	147
Thulin, A. L. ....	100
Tiedemann & Harris, Inc. ....	145
Tittle, H. S., Co. ....	133
Todt & Peters. ....	174
Tonkin Distributing Co. ....	160
Torre, G. B., & Sons ....	148
Townsend's ....	153
Triple "A" Garage ....	170
Trouillet, Mme. J. ....	179
Troy Laundry Machinery Co. ....	68
Truman Undertaking Co. ....	149
Tubbs, Tallant. ....	18
Turko-Persian Rug Co. ....	110
Turner-Whittell Warehouses .....	170
Tustin .....	65
Tway, John H. & Sons ....	162
Tyre Bros. Glass Co. ....	164

## U

Uhte, Wm. C. ....	148
Unecda Shade Co. ....	170
Union Building & Loan Assn. ....	95
United Engineering Co. ....	127
Union Furniture Co. ....	126
Union Garage. ....	165
Union Machine Co. ....	151
United Commercial Co. ....	138
United Paper Box Co. ....	117
U. S. Garage ....	176
U. S. Laundry ....	183
U. S. Pipe Bending Co. ....	102
United States Steel Products Co. ....	132

U. S. Veterans Auto Repair Shop .....	142
Universal Electrical Works ....	138

## V

Valente, Marini, Perata & Co. ....	13
Van Cott, W. S., Co. ....	92
Van Fleet-Freear Co. ....	157
Van Laak Bros. & Co. ....	154
Van Ness Super Service Station .....	142
Varney, F. W. ....	151
Vetter, August, Sons. ....	172
Victoria Pastry Co. ....	94
Vienna Bakery and Restaurant .....	117
Vosinkel, Henry ....	128
Vulcan Macaroni Co. ....	150
Vulcan Welding Works ....	92

## W

Wass, Henry, Co. ....	186
Walkup Drayage & Warehouse Co. ....	148
Walk-Over Shoes ....	175
Warfield Luggage Shop. ....	138
Washington Pastry Co. ....	104
Washington Square Metal Works. ....	189
Waters, Jas. F. .... Back Cover	
Water Service Co. ....	148
Water Works Supply Co. ....	10
Watkins, Arthur ....	126
Watson Coat and Apron Supply Co. ....	52
Weaver, Chester N. Co. ....	8
Weinberg Bros. ....	124
Weinholz, M. George. ....	180
Weishein Bros. & Co. ....	194
Welding Engineering Co. ....	151
Werner, Frank, Co. ....	25
Werner, O. F. ....	153
Werner, W. A. ....	94
West American Commercial Insurance Co. ....	67
West Coast Cleaning & Dyeing Works. ....	168
West Coast Laundry Machinery Co. ....	74
Wesley-McCauley-Furlong Co. ....	158

Western Furnace & Cornice Co. ....	151
Western Furnace and Sheet Metal Works. ....	145
Western Hardwood Floor Co. ....	129
Western Sheet Metal Works ....	175
Western Woodworking Co. ....	152
Weinstein's Department Store ....	41
Wesel, Allyn S. ....	154
Whiffer, Arthur R. ....	92
Whitcomb Hotel ....	50
White Co. ....	94
White Brothers ....	188
White House Dyeing & Cleaning Works. ....	80
Whitelaw, T. P. H. ....	164
Wiley Transfer & Storage Co. ....	180
Willard's ....	42
Williams-Wallace Co. ....	166
Willig's Auto Rental ....	136
Wilson's ....	184
Wilson, the Coffee Man ....	153
Winkler, Geo., Co. ....	158
Wolf, B. R., & Co. ....	174
Wood, P. W. ....	126
Woodward, Geo. H. ....	163
Wong Him, Dr. H. ....	141
Wong & Low ....	116
Workman Packing Co. ....	165
Wright, E. W., & Sons ....	127

## Y

Yere French Bakery ....	114
Young & Co. ....	139
Young & Horstmeier ....	104
Young, S., Tailoring Co. ....	130
Yuba Manufacturing Co. ....	72
Yuen Ming Low ....	164

## Z

Zaro, Geo. N. ....	126
Zelinsky, D., and Sons ....	172
Zoalite. ....	19



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